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Report No. 202a-KO

REPUBLIC OF KOREA

APPRAISAL OF

KOREAN SEEDS PROJECT

September 28, 1973

Regional Projects Department
Asia Regional Office

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CURRENCY EQUIVALENT

Won 400	=	US$1.00
Won 1.00	=	US$0.0025
Won 1 million	=	US$2,500

WEIGHTS AND MEASURES

1 meter (m)	=	3.28 feet
1 square meter (m^2)	=	10.76 square feet
1 kilogram (kg)	=	2.205 pounds
1 metric ton (t)	=	2205 pounds
1 hectare (ha)	=	2.47 acres
1 kilometer (km)	=	0.62 miles

ABBREVIATIONS

ADC	=	Agricultural Development Corporation
APB	=	Agricultural Production Bureau
COA	=	College of Agriculture
EPB	=	Economic Planning Board
FLIA	=	Farmers Land Improvement Association
MAF	=	Ministry of Agriculture and Fisheries
NACF	=	National Agricultural Cooperative Federation
NAPIO	=	National Agricultural Products Inspection Office
NSC	=	National Seeds Council
ORD	=	Office for Rural Development
OSPD	=	Office for Seed Production and Distribution
PORD	=	Provincial ORD Research and Registered Seed Farm
RGO	=	Rural Guidance Officer
ROK	=	Republic of Korea

KOREAN FISCAL YEAR

January 1 to December 31

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

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KOREAN SEEDS PROJECT

SUMMARY AND CONCLUSIONS

i. This report appraises a project to establish a modern seeds industry for paddy, barley, wheat, soybean and potato in Korea for which a Bank loan of US$7.0 million (Won 2,800 million) has been requested.

ii. Agriculture contributes about 30% of Korea's GNP, employs about half the labor force and provides raw materials and labor for a dynamic industrial sector. Since 1962, manufacturing output has increased at the rate of 20% per annum, whereas agricultural output has increased at only 3.5% per year. Annual imports of food, i.e., rice, barley and wheat exceed 2.8 million tons; more than five times the rate of seven years ago. The current Five-Year Plan places greater emphasis on agriculture and rural development in an effort to achieve a more equitable income distribution and accelerate food production towards greater self-sufficiency.

iii. The existing Government sponsored seeds program produces more than 40,000 tons of field crop and potato seed each year. However, with seed production widely dispersed in the villages and with lack of equipment and modern production, processing and storage methods, the quality of seed available for distribution and general use is poor. Because of their low quality, farmers do not use the government seeds. The proposed project would help solve the problems of seed varietal mixtures, low germination and seed borne diseases inherent in the existing system. The project would also provide the means for developing new higher yielding varieties and the rapid multiplication and distribution of the new seeds under quality controlled conditions. At full development an estimated 11,000 tons of paddy, 5,000 tons barley, 1,000 tons wheat, 500 tons soybeans and 10,850 tons potato would be produced, processed, stored and distributed as Certified seeds. At least 500,000 or 20% of the Korean farmers would benefit from the use of project Certified seeds. The foreign exchange savings would be the annual import cost equivalent of about US$14.0 million for 80,000 tons of foodgrains, 7,500 tons of oilseeds and 60,000 tons of potato.

iv. The project would finance (a) the installation of five field crop seed processing and storage facilities of about 3,500 tons capacity each and six seed potato facilities of about 2,000 tons each; (b) farm machinery for seed production; (c) incremental operating capital for procuring seasonal seeds inventories; (d) seed testing laboratories and equipment; (e) crop research; (f) feasibility studies for irrigation and area development; and (g) technical assistance.

v. The Ministry of Agriculture and Fisheries (MAF) would provide overall coordination for the project. The Office for Seed Production and Distribution (OSPD) would operate the seed facilities. It would contract with a farmers cooperative near each plant site for the production of the

required amount of seeds and would procure, process, store and distribute seeds throughout the country. The National Agricultural Products Inspection Office (NAPIO) would be responsible for quality control. The agency responsible for agricultural research, the Office of Rural Development (ORD) would be strengthened by a parallel financing arrangement with USAID. ORD would expand its crop breeding work and provide OSPD with Registered seed of the new higher yielding varieties for multiplication and distribution to farmers. Expatriate consultants would assist with the feasibility studies and in the implementation of the project and the training of staff.

vi. The project, as proposed, would cost US$22.8 million (Won 9,132 million). Of this amount, the Bank would finance US$7.0 million and the USAID would finance US$5.0 million. The ROK would provide US$10.8 million. Disbursement under the Bank loan would cover the cost of seed plants, equipment, vehicles, consultant services and overseas training. It would also cover 68% of the cost of civil works. All contracts above US$50,000 would be awarded after international competitive bidding.

vii. Project Certified seeds, when used by farmers to replace local seeds, would be expected to obtain yield increases of 6% for paddy, 12% for barley and wheat, 10% for soybeans and 50% for virus-free potato. At these rates of increase, the project's economic rate of return (ERR) would be 48%. If yield increases of only half of these rates were obtained the ERR would be 23%. With 15% higher investment costs and 25% lower volume the rate of return would be 33%. Rates of return are sensitive to crop yield responses due to the use of Certified seeds, prices for seeds, grains and potato, the inclusion of seed potato and the achievement of targeted full development volume.

viii. During negotiations the ROK agreed to complete acceptable arrangements for parallel financing of ORD with USAID and to establish the OSPD. It also provided assurances regarding administrative and operational arrangements. The appropriate assurances having been agreed, the project is suitable for a Bank loan of US$7.0 million for 25 years including seven years grace with interest.

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

I. INTRODUCTION

1.01 The Republic of Korea (ROK) has requested a Bank loan to help finance (a) improvements in its existing seeds industry and to develop new higher yielding varieties of cereal crops, oilseeds and potato for multiplication and distribution to farmers and (b) feasibility studies for two irrigation and area development projects. The proposed project would make an important contribution to the achievement of ROK's current five-year development plan which places increased emphasis on agriculture and rural development.

1.02 The proposed loan would be in addition to the Bank Group Loan-Credits previously granted for agricultural development projects in Korea. Two were for irrigation, Bank 600-KO for US$45 million and a combined IDA Credit 283-KO and Bank Loan 795-KO for US$48 million. IDA 234-KO of US$7.0 million was for livestock development and 335-KO of US$10.5 million was for an Agricultural Credit project. These projects support ROK's agricultural development strategy which has the following objectives: (a) achieving a more equitable income distribution; (b) improving rural infrastructure to meet social needs; (c) conserving and developing land and water resources; and (d) accelerating and expanding food grain and potato production to attain greater self-sufficiency in foods.

1.03 The proposed project was prepared with the assistance of the FAO/IBRD Cooperative Program and submitted to the Bank by ROK. This report is based on the findings of an appraisal mission consisting of Messrs. Dorris D. Brown, U. Hpu, L. Lundquist (IBRD); A.A. Huysmans (FAO) and L.S. Foster (Consultant) that visited Korea in February/March 1973.

II. NEED FOR THE PROJECT

A. General

2.01 Agriculture accounts for about 30% of Korea's GNP, employs about half the labor force and provides raw materials for a large share of the more dynamic industrial sector. Since 1962, manufacturing output has increased by about 20% and industrial exports by 40% annually; much higher than the 3.5% growth rate for agricultural production including forestry and fisheries. Under-employed farm labor has migrated to the urban areas. However, real incomes of farm households increased about 60% from 1961 to 1971 while real incomes of urban households more than doubled (Annex 1).

2.02 Korea has only 2.3 million ha of cultivated land, about 0.07 ha per person for its population of over 30 million. About 2.5 million farm families live in 35,000 rural villages and operate small and fragmented land holdings that average 0.9 ha per household. As a result of land reforms initiated in 1950, almost all farms are owner-operated. An aggressive consolidation and land development program executed by the Farmer's Land Improvement Association (FLIA), has regrouped about half of the fragmented paddy land into larger operating units. About two-thirds of the paddy, barley and wheat lands are irrigated. Farmers are progressive and diligent workers, eager to apply new technology that increases output and income.

2.03 Agricultural output, excluding forestry and fisheries, increased at an annual rate of 3.3% during 1961 to 1971. About two-thirds of the increase in crop output was from higher yields and one-third from expanded area planted. Livestock, poultry, fruits, vegetables and industrial crops production increased rapidly. The 1967-71 average cropped area, production and yield by provinces are given in Annex 1, Table 1, illustrated on IBRD Map 10447, and summarized below:

	Area (mil. ha)	Production (mil. tons)	Yield (Kgs/ha)
Paddy	1.20	5.23	4,358
Regular Barley	.44	1.17	2,643
Naked Barley (huskless)	.48	1.33	2,755
Wheat	.15	.34	2,216
Soybeans	.30	.23	756
Potato (White)	.06	.60	10,625

Agricultural production has not kept pace with growing market requirements. The import of 2.8 million tons of rice, barley and wheat in 1972 was more than five times that of the early 1960s.

2.04 The Ministry of Agriculture and Fisheries (MAF) is responsible for the planning and implementation of agricultural development programs. Assisted by the Economic Planning Board (EPB) it plans, finances and monitors numerous departmental agencies and organizations. It operates an extensive price policy and grain procurement program through the National Agricultural Cooperative Federation (NACF) that assures farmers of relatively high crop production incentives and easy availability of such inputs as fertilizers, plant protection materials and improved seeds. MAF channels most of its field activities of direct concern to farmers through the nine provincial governments which have similar organizational structures.

2.05 Government support programs for barley, soybeans, maize and other crops have been carried out by the MAF to encourage output expansion and to improve farm incomes. Producer prices for rice and other grains were near those at which imports were available in 1965, but the Government support price for rice was raised each year until it reached US$242 per metric ton in 1972, about 50% above the import price of US$166 a ton. Producer

support prices for polished barley have been at 67% of those for rice, but the retail price of barley has been maintained at 50% of that for rice in order to encourage consumption substitution of barley for rice. Real incomes per farm household have increased since 1965 largely as the result of higher farm product prices. However, rice production has not increased significantly indicating that other measures such as improved water management, new high yielding varieties, and better disease and pest control practices may be required to expand production.

2.06 Korea's land, water and human resources provide the potential for a more dynamic agricultural sector. The ROK five-year development plans emphasize development and dissemination of new farming technologies as well as investment in rural infrastructure. The proposed project with its crop research, seeds and feasibility studies of irrigation and area development forms a part of this strategy.

B. Agricultural Research, Extension and Credit Institutions

2.07 Research: The Office of Rural Development (ORD) carries out the MAF agricultural research program. Facilities for research work on cereal crop breeding and cultural practices are located at Suweon and at field stations at Honan and Milyang. The new high yielding Tongil variety of paddy was developed by a College of Agriculture plant breeder working with the ORD staff. Since its release in 1970, this variety has spread to about one-sixth of the paddy area. Another promising high yielding variety of paddy is likely to be released for seed multiplication by 1975 or 1976. Other promising varieties are under laboratory and field tests (Annex 3).

2.08 Research on barley is being undertaken in attempts to improve resistance to cold weather and develop earlier maturity of higher yielding varieties. Wheat and soybean research includes the testing of exotic varieties. Potato research is concentrated at the Alpine Station in Gang Weon Do province where the breeding of improved crosses with the local Irish Cobbler variety and the control of virus diseases receives major emphasis. A new higher yielding variety is under field test for probable release by 1975.

2.09 A seeds program of the type proposed requires a stream of new, higher yielding varieties flowing from the research agencies to replace outdated existing varieties. Despite improvements in recent years, ORD's research resources are inadequate to support a seed production and distribution program as extensive as the proposed project. It is not adequately staffed, particularly in the plant breeding aspects of plant pathology, entomology and cereal chemistry. ORD also needs additional equipment to enable it to expand its crop research and to produce the Foundation and Registered seed needed for the project. The Government is arranging to finance ORD's needed support through a loan agreement with the USAID (See para 3.12).

2.10 Extension: ORD is the executing agency, assisted by the provincial governments, for agricultural extension education programs. Technical guidance and training given by ORD is extended by about 6,500 Rural Guidance (Extension) Officers (RGOs) and 15,000 agricultural workers and leaders posted in country and local offices. They assist farmers obtain production inputs and use improved cultural practices consistent with the latest research results. The agricultural staff has supported the existing government seed program by conducting crop demonstrations, arranging for progressive farmers to grow seeds of the recommended varieties and assisting in the distribution of seed supplies (Annex 1).

2.11 Colleges of Agriculture: The Colleges of Agriculture (COA) in the Ministry of Education engage in crop research and training of technicians in crop breeding, cultural practices and extension. The COA have expertise in plant pathology and plant chemistry that, in general, are not available with ORD. ORD engages selected COA staff members to assist in some of its crop research and staff training work. However, lack of coordination between the MAF and the Ministry of Education and inadequate financing has hindered full cooperation between the COA staff and ORD.

2.12 Agricultural Credit: The Government sponsored cooperative system, National Agricultural Cooperative Federation (NACF), is the main source of institutional credit. Interest rates for NACF credit range from 3.5% for long term irrigation loans to 15.5% for certain kinds of medium term production and facility loans. The largest volume of loans is at 9%. These rates may be compared with Korean Development Bank industrial loans ranging from 7.5 to 16.5% and commercial bank rates mainly in the 6 to 15.5% range. Farmers get most of their credit from non-institutional sources at rates of 4 to 6% per month. Loans available in the cooperative system from the Government budget and from its own banking operations fall far short of meeting the demand at the terms offered so rationing of available credit by NACF is necessary. There are no good estimates of aggregate credit needs of farmers, but lack of credit has not retarded growth in use of fertilizer or pesticides and is not expected to restrain the proposed seeds project (Annex 1).

C. The Seeds Industry

2.13 Agricultural Production Bureau (APB): The APB is responsible for the planning and implementation of agricultural development programs including the national field crop and potato seeds program. It performs these functions in cooperation with the Economic Planning Board, ORD, and the provincial governments. Seed varieties to be multiplied and distributed are determined by the provincial governments. ORD multiplies the Breeder and Foundation seeds of these varieties and provides Foundation seeds to the Provincial Organization for Rural Development (PORD) seed farms. The next stage, Registered seed produced on the PORD seed farms, is distributed by each provincial government to its selected seed growers located in most villages for reproduction as "Certified" seed. The seed growers distribute this seed to village farmers under an ad hoc system and receive varying

incentive payments from the provincial government for their seed production distribution operations. There is an organized private sector seeds industry for vegetable and flower seeds but not for field crops and potato (Annex 2).

2.14 Registered seed potato is produced at the PORD seed farm in Gang Weon Do province (See IBRD Map No. 10516) and distributed to selected growers in all of the provinces. Seed borne virus diseases develop when this seed is reproduced at altitudes below 800 m. Thus, some of the seed potato available for general distribution is not free from diseases and its quality degenerates rapidly. Average potato yields of 10.6 tons per ha are much lower than the potential of 15 tons with existing varieties and over 20 tons with new varieties.

2.15 The National Seeds Council (NSC): Overall policy direction of the seeds industry is the responsibility of the Ministry of Agriculture advised by the National Seeds Council (NSC) which consists of the MAF Vice-Minister as Chairman and representatives of MAF, ORD, NAPIO and the Universities (Annex 3). The NSC has not had the desired influence on the national seeds policy that the Seed Law intended; mainly, because (a) the provincial governments and the seeds industry have not been represented on the Council; (b) it has not had a role in guiding minimum regulatory standards and procedures; and (c) it has not been concerned with the effect of crop improvement research policies on the seeds industry. As a result, non-recommended varieties with relatively poor performance continue to be multiplied and distributed by the provincial governments without adequate control of seed quality.

2.16 The National Agricultural Products Inspection Organization (NAPIO): The National Agricultural Products Inspection Organization (NAPIO) is responsible for the inspection and regulation of quality control for all agricultural products, including seeds, that move through domestic and export market channels (Annex 5). Its basis of authority for seeds is derived from the Seed Law of Staple Crops, (Law No. 975) January 16, 1962, as amended. The central office in Seoul has an administrative and technical staff with laboratories and equipment needed to perform its functions for agricultural food products. Field staff and facilities are maintained at 141 local offices. Its work in seed inspection and quality control has been restricted mostly to vegetable seeds. The provincial Governments have been reluctant to use its services for seeds produced and marketed by selected village farmers. In the few cases where NAPIO services were requested, such seeds usually failed to pass field and laboratory inspections for purity and germination.

2.17 The Seeds Law reflects awareness of the requirements for the control of seed quality by defining the successive multiplication procedures through the Breeder, Foundation, Registered and Certified seed stages. It specifies minimum standards for Certified seed of each promulgated crop. It defines the responsibilities of the agencies concerned - ORD, NAPIO and others - and provides penalties for non-compliance. However, the system breaks down on compliance with quality control at the Certified seed multiplication and distribution stages. The law does not provide for the registration and regulation of Certified field crop and potato seed growers or for the licensing of seed dealers and regulation of the quality of seeds

they market. The services of NAPIO are not used. Indeed, NAPIO does not have adequately trained staff for field inspection of a progressive Certified seed production and marketing program. It lacks laboratory equipment and trained staff for seed sample analysis.

2.18 Government Seeds: Seed production and distribution by the Government seed program for 1969-71 was estimated as follows:

	Annual Crop Area	Seed Rate	Amount of Seed Required	Amount of Seeds Produced and Distributed		
				1969	1970	1971
	Million ha.	Kgs./ ha.	thousand tons			
Paddy	1.2	40	48.0	6.7	10.3	22.0
Barley	.92	65	60.0	17.0	16.4	13.7
Wheat	.15	55	8.4	2.5	4.2	3.9
Soybeans	.30	55	16.5	1.3	2.1	1.0
White Potato	.06	1,000	60.0	n.a.	7.7	6.0

2.19 Seed production incentive payments and staff operations cost the Government over US$1.0 million per year. Quality control measures for varietal and species purity and germination have not been applied successfully at the selected seed grower and distribution levels. Some of the seeds produced have been consumed as foodgrain or potato rather than used as seed. Because of low quality and poor performance, demand for "Certified" seeds has diminished.

D. Irrigation and Area Development

2.20 In Korea, the expansion of crop production depends almost entirely on increasing output from the presently cultivated area. In the last decade the area of paddy used to grow two crops - paddy and barley or wheat - increased from 402,000 ha to 634,000 ha. But over 600,000 ha of paddy land continues to be used to grow only one crop, mainly because of poor drainage and lack of irrigation facilities. The ROK plans to make large investments for land and water resource development to expand its agricultural production base, help achieve self-sufficiency in foodgrains, control erosion, reduce flood damage and improve rural income. The Agricultural Development Corporation (ADC) has the major responsibility for the completion of feasibility studies, design and construction of irrigation and area development projects. However, ADC does not have the staffing and expertise needed to implement projects currently under construction (para 1.02) and simultaneously prepare feasibility studies for all of the new projects under consideration for the Third Plan (1972-76). They therefore require assistance from consultants in project planning and implementation. At the Government's request, financing for the engagement of consultants and other foreign exchange expenditures associated with the preparation of two feasibility studies, one by ADC and one by MAF, are being included as part of this project.

III. THE PROJECT

A. Definition

3.01 The project would finance the establishment of a modern seeds industry in Korea, strengthen the agencies responsible for crop research (ORD) and for seed certification (NAPIO) and provide for feasibility studies of prospective irrigation and area improvement works. At full development, the seed facilities would procure, process, store and distribute 11,000 tons paddy, 5,000 tons barley, 1,000 tons wheat, 500 tons soybeans and 10,850 tons seed potato as Certified seed per annum. Yield increases resulting from the investment would benefit directly more than 500,000 Korean farmers and help ROK achieve greater food self-sufficiency.

3.02 The project would include:

(a) the installation of five field crop seed processing and storage facilities of about 3,500 tons capacity each and six seed potato facilities of about 2,000 tons each;

(b) farm machinery for seed production;

(c) a revolving fund for seed procurement;

(d) seed testing laboratories and equipment for quality control (NAPIO);

(e) staff, equipment and training for crop research (ORD);

(f) feasibility studies for the Okseo-Naeseong Cheon and Hwang Gang irrigation and area development regions (MAF-ADC); and

(g) technical assistance.

3.03 The MAF would provide overall guidance and coordination for the project. A new agency, the Office for Seed Production and Distribution (OSPD) would be established in the MAF under a revised Seeds Law to operate the seed production, processing and storage facilities and distribute the seeds. The NAPIO would be responsible for seed quality control. The USAID would provide parallel financing for the ORD crop research. The MAF and Agricultural Development Corporation (ADC) would supervise the feasibility studies. The project would be completed in five years with retroactive financing of Bank approved consultancy contracts from September 1, 1973.

B. Detailed Features

3.04 Field Crop Seed Processing: The five field crop seed processing and storage facilities would be located at Pyeongtaeg, Iri, Hampyeong, Euiseong and Milyang (see IBRD Map 10516). Criteria used to determine plant locations included (a) availability of perennially irrigated land for seeds production; (b) distance and transportation resources to potential markets for seeds; (c) farmers interested in adopting the procedures required to produce certified seeds; and (d) the availability of electricity, housing and staff amenities.

3.05 Each plant would be provided with identically designed intake, conveying, drying, cleaning, treating and packaging equipment to process about 1,500 tons of barley and wheat during the first 15 or 20 days in June. The same equipment could process over twice this volume of paddy and soybeans during the 30 to 45 day October-November harvesting and drying season. Minor changes in building design and storage capacities would accommodate the availability of local building materials and differences in quantities and types of seeds to be processed at each location. Details including a typical plant layout are given in Annex 4. Plant equipment specifications are given in Annex 9.

3.06 At full development, the five plants would process, store and distribute 11,000 tons of paddy, 5,000 tons barley, 1,000 tons wheat and 500 tons soybean as Certified seed. These quantities represent estimated demand for the existing varieties and would provide the following proportions of the national annual seed requirements: paddy, 23%; barley, 8%; wheat, 12%; and soybeans, 3%. The projected volumes are substantially lower than the amounts distributed in 1970 and 1971 (see para 2.18). However, the volume and proportions would change with demand and when new varieties of paddy, barley and soybeans are approved for multiplication by the project as expected in 1975 and 1976 (Annex 3). With adjustments in operating procedures and additions to storage, if needed, the volume processed could be expanded.

3.07 Seed Potato Storage and Processing Plants: To control virus diseases, seed potato must be produced at elevations above 800 m and with a regime of plant protection from insects and diseases. The project would provide potato grading and treating equipment and storage facilities to produce about 2,000 tons of Registered seed potato at the Daegwanryeong PORD seed potato farm in Gang Weon Do province and similar facilities at five nearby locations to produce 10,000 tons of Certified seed under contract with farmers located above 800 m elevation on the scattered and remote cultivable land in the region. The adjacent ORD Alpine Potato Research Station would provide research and technical assistance. Management of the Daegwanryeong PORD seed potato farm, now owned by ORD would be transferred to the OSPD. This transfer is necessary to assure OSPD of its supply of Registered seed and to operate the farm more efficiently in relation to its needs. During negotiations, assurances were obtained that the transfer would be made.

3.08 Farm Machinery for Seed Production: At most of the cereal plant sites, barley and wheat would be planted after the paddy seed harvest in October. The barley and wheat seed must be harvested in about 15 days during early June and the land immediately prepared for transplanting paddy before the first of July. Similar timely operations are required for seed potato production. Bullock operated equipment which most farmers use and the current short agricultural labor supply would not permit these operations to be completed within the time constraints. Consequently, tractors and machinery for land preparation and harvesting operations would be provided to the OSPD for hire to farmers.

3.09 Registered Seed: In the existing seed industry the ORD plant breeders are responsible for the production of the Registered seed for field crops at the PORD seed farm in each province (Annex 2). This arrangement would be continued under the project. However, the PORD farms that would be used for the production of the Registered seed requirements of the OSPD lack modern seed production and processing equipment which the project would provide. During negotiations, the Bank was assured that ORD would continue to be responsible for the production of Registered seed of the recommended varieties and in the amounts required by OSPD for multiplication as Certified seed.

3.10 Seed Certification and Quality Control: To produce and market seeds of cereal crops, soybean and potato that meet acceptable inspection and quality control standards for certification, it would be necessary to revise the Seed Law of Staple Crops, Law No. 975 and strengthen NAPIO's seed inspection and laboratory facilities and equipment (para 2.17 and 4.14).

3.11 Technical Assistance and Training: The MAF has limited experience and technical talent in the production, procurement and processing of seeds that meet acceptable quality standards for Certified seed (para 2.13 - 2.19). Therefore, the project would provide about 14 man-years of expatriate technical assistance to advise and train the OSPD and NAPIO management and staff in the performance of these functions. Training would be guided by the consultants and would include overseas scholarships. Proposed draft terms of reference for the consultants are given in Annex 6. During negotiations, assurances were given that consultants would be selected in accordance with procedures and terms of reference acceptable to the Bank.

3.12 Crop Research - Parallel Financing: The project's success would depend, in part, on the systematic introduction of new higher yielding varieties for each crop (paras 2.07 - 2.09). To achieve this objective, the ROK is arranging with the USAID for the financing of additional crop research. Their loan would, during the next five years, provide for about 75 man-years of expatriate technical assistance of a team of plant breeders, pathologists, entomologists, agronomists, agricultural engineers and farm management economists, the training of ORD and COA staff, additional equipment and facilities. The work would concentrate on the improvement of cereal grains, soybeans, potato and forage crops. The estimated costs have been included in project financing. Tentative details are given in Annex 3. It would be a condition of effectiveness that arrangements acceptable to

the Bank had been finalized by ROK and USAID for the financing of additional crop research.

3.13 Feasibility Studies of Future Projects: The loan also would finance the foreign exchange cost (US$900,000) of two feasibility studies (para 2.20). The first would be the Okseo Irrigation and Area Development Project located south of the Geum River and adjacent to the Iskan and Nonsan subdivisions of the Pyongtaek-Kumgang Irrigation Project (Loan 600-KO). The project would improve irrigation and drainage in some 80,000 ha presently irrigated mainly by gravity from a large number of storage reservoirs and provide for construction of an irrigation and drainage system to serve about 52,000 ha presently cultivated under rainfed conditions. The project would also include provisions for community development as well as municipal and industrial water supply. A consulting firm would be engaged, under terms of reference as outlined in Annex 6, Appendix B, to assist the Agricultural Development Corporation in implementing this study which is expected to be completed by September 1974.

3.14 The second study would be for the integrated development of two watershed areas: Naeseong Cheon (178,000 ha) and the Hwang Gang (133,000 ha). Field work would start in September, 1973 and would be completed by December, 1974. The proposed project preparation would be based largely on the work of the UNDP/FAO Upland Development and Watershed Management Project in Korea and would include physical surveys, map preparation of semi-detailed soil and land use capabilities; agro-economic surveys; investigation of water storage facilities including sites for new dams, improvement of new dams and selection of sites for fish ponds; and surveys of existing communities and prospective community development programs. The proposed project would likely include erosion control and reforestation in the basin catchments, bench terraces for orchards and field crops, pasture improvement, small reservoirs and structures for irrigation, land consolidation, fish ponds and community development activities for beef, pig and poultry schemes, farm mechanization, storage, village water supply, etc. The Korean counterparts of the UNDP/FAO project have been trained in feasibility study and project preparation work for the past six years and would assume the responsibility for this study. Policy direction would be provided by a coordinating committee established by the MAF on April 10, 1973 and under the Chairmanship of the Vice-Minister. The above Korean staff would implement the study with assistance from consultants engaged on short-term assignments under procedures and terms of reference acceptable to the Bank.

C. Cost Estimates and Financial Arrangements

3.15 The estimated project cost would be US$22.8 million (Won 9,132 million). Details are given in Annex 7 and summarized below:

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange
	----Won millions-----			------US$'000-------			%
1. Seed Production and Processing (OSPD)							
Land	137		137	343		343	-
Administration	132	9	141	330	25	355	7.0
Buildings	188	400	588	471	1000	1471	68.0
Machinery & Equipment	75	503	578	186	1259	1445	87.1
Farm Machinery	16	383	399	40	958	998	96.0
Vehicles	3	76	79	8	189	197	95.9
Office Equipment	9	9	18	22	23	45	51.1
Consultants	-	168	168	-	420	420	100.0
Training	21	12	33	52	31	83	37.3
Revaluing Fund (Seeds)	2160		2160	5400		5400	-
Sub-total	2741	1560	4301	6852	3905	10757	36.3
2. Registered Seed Farms (ORD)							
Farm Machinery and Equipment	2	35	37	4	93	97	96.4
3. Seed Certification (NAPIO)							
Land	21		21	52		52	-
Buildings	10	21	31	25	53	78	56.4
Equipment	4	41	45	9	103	112	92.0
Vehicles		10	10	1	26	27	96.3
Consultants	6	60	66	15	150	165	90.9
Training	8	5	13	21	11	32	36.4
Sub-total	49	137	186	123	343	466	73.6
4. Crop Research (ORD-USAID)	1200	2000	3200	3000	5000	8000	62.5
5. Feasibility Studies (MAF-ADC)	240	360	600	600	900	1500	60.0
6. Contingencies							
Physical	68	168	236	169	420	589	71.3
Price - Local	73		73	183		183	-
Foreign		499	499		1248	1248	100.0
Sub-total	141	667	808	352	1668	2020	82.6
GRAND TOTAL	4373	4759	9132	10931	11909	22840	52.1

3.16 These estimates were based on 1973 quotations cif Korean ports for equipment expected to be imported and local rates for civil works and administration. The local expenditures for consultants was included under administration. A physical contingency of 10% and price contingencies of 5% for local expenditures and 12% per annum for foreign exchange were calculated for items under Sections 1, 2 and 3 above. The amounts given in Sections 4 and 5 include contingencies. The foreign exchange component of US$11.9 million is 52.1% of project costs.

3.17 Financing. A Bank loan of US$7.0 million (Won 2,800 million) is proposed to assist in the financing of the project. The proposed financing arrangements are:

	ROK		USAID		IBRD		Total
	US$ 000	% of Total	US$ 000	% of Total	US$ 000	% of Total	Project Costs US$ 000
I. Seed Prod. & Processing							
Land	343	1.5					343
Administration	355	1.6					355
Buildings	471	2.1			1,000	4.4	1,471
Machinery & Equip.	40	0.2			1,405	6.2	1,445
Farm Machinery	40	0.2			958	4.2	998
Vehicles	8				189	0.8	197
Office Equipment	22	0.1			23	0.1	45
Consultants					420	1.8	420
Training	52	0.2			31	0.1	83
Revolving Fund	5,400	23.6					5,400
Sub-total	6,731	29.5			4,026	17.6	10,757
II. Registered Seed Farms							
Machinery and Equip.	4				93	0.4	97
III. Seed Certification							
Land	52	0.2					52
Buildings	25	0.2			53	0.2	78
Equipment	9				103	0.5	112
Vehicles	1				26	0.1	27
Consultants	15	0.1			150	0.7	165
Training	21	0.1			11		32
Sub-total	123	0.6			343	1.5	466
IV. Crop Research	3,000	13.1	5,000	21.9			8,000
V. Feasibility Studies	600	2.6			900	3.9	1,500
VI. Contingencies	382	1.7			1,638	7.2	2,020
GRAND TOTAL	10,840	47.5	5,000	21.9	7,000	30.6	22,840

3.18 The proposed Bank loan of US$7.0 million (Won 2,800 million) to ROK would finance about 31% of the estimated project cost. Terms would be for 25 years with seven years grace and annual interest. ROK would use about US$5.6 million, including contingencies to finance the installation of seed plants. The remainder of the Bank loan would be used by ROK to finance machinery and equipment for the PORD seed farms (US$93,000), NAPIO (US$343,000) and the feasibility studies (US$900,000). The USAID parallel financing of US$5.0 would be for ORD crop research and represents 22% of project costs.

D. Procurement and Disbursement

3.19 The civil works and machinery and equipment for the five field crop seed processing plants, estimated at US$2.0 million, including installation and test-run, would be subject to international bidding in accordance with the Bank's Guidelines on Procurement. Bids would be called on the basis of two alternatives: either (a) one single contract for the supply and construction of the five plants; or (b) one single machinery and equipment supply and erection contract for the five seed plants and five separate civil works contracts. Prequalified contractors could bid on any one or a combination of the works. The civil works for the seed potato storage facilities estimated at US$835,000 would be bid separately. Farm machinery (US$1.1 million) and vehicles (US$223,000) would be purchased by international bidding. Domestic bidders offering machinery and equipment of substantial Korean origin would be entitled to a 15% preference or actual import duty, whichever is less. Other equipment (including the seed potato processing equipment, seed certification laboratory equipment and office equipment), costing less than US$50,000 when bulked, would be procured directly from local or international supplier under arrangements acceptable to the Bank. Civil works for the NAPIO laboratories (US$78,000) are at seven scattered locations and would be tendered locally. Consultants would be appointed in accordance with the Bank's Guidelines. The MAF would nominate key OSPD and NAPIO staff members for international training under arrangements acceptable to the Bank. During negotiations assurances were obtained from ROK on the above arrangements.

3.20 Disbursement of the proposed Bank loan would be against the following items: (a) the cif or ex-factory cost less identifiable taxes and duties, of all farm machinery, vehicles and seed quality control equipment; (b) 100% of the total cost of seed plant equipment inclusive of the local costs of installation and test operations (US$145,000) less identifiable taxes and duties; (c) 68% of the cost of civil work contracts awarded under arrangements acceptable to the Bank; and (d) the foreign exchange cost of technical assistance and overseas training. Due to the need to use consultants to initiate project actions for the OSPD and for the feasibility studies, retroactive financing of not to exceed US$300,000 would be acceptable for consultant services provided after September 1, 1973 with the approval of the Bank. Disbursements would not be made against costs of land

acquisition, administration, Revolving Fund capital and local costs for the consultants, training, crop research and feasibility studies. The schedule for disbursement is in Annex 10.

IV. ORGANIZATION AND MANAGEMENT

A. General

4.01 The MAF would be responsible for overall supervision of project investments and coordination of the appropriate departments, agencies and provincial governments. The OSPD would be responsible for the operation of the seed plants including the production, procurement, processing, storage and distribution of seeds. NAPIO would manage the seed certification services for the project and for the Korean seeds industry (para 2.16 and Annex 5). Crop research and the production of Breeder, Foundation and Registered seed would be managed by ORD (para 2.07 and Annex 3). The NSC would assist the MAF by recommending seed varieties for multiplication each crop season and by providing suggested general standards for seed certification and regulation of the industry (para 2.15 and Annex 3). All of these departments and agencies, except OSPD are experienced in working together under the leadership of the MAF for the operation of the existing crop research and seed programs (Annex 2). The MAF and ADC would supervise the feasibility studies (para 2.20). Functional responsibilities for each department and agency are summarized below and detailed in Annex 6.

B. The Office for Seed Production and Distribution (OSPD)

4.02 The OSPD would be established by the ROK by amending the Seed Law of Staple Crops (Law No. 975) of January 16, 1962 as amended (Annex 6). It would operate as a separate agency in the MAF under regulations issued pursuant to the Seed Law and under the direction of a Chief Executive Officer who would be responsible directly to the Assistant Minister. Administrative divisions of the OSPD would be responsible for project administration and operations, financing and budget control, seed production and procurement, farm machinery operations and seed processing and distribution. A manager trained in seeds production processing, storage and marketing, would be in charge of operations at each seed plant. During negotiations agreement was reached regarding the following conditions:

(a) OSPD would be established by not later than 12 months from the date of loan effectiveness and with satisfactory terms, conditions, regulations and administrative procedures acceptable to the Bank;

(b) No disbursement would be made, except for consultants, until the above conditions had been fulfilled;

(c) The Chief Executive Officer posted would be acceptable to the Bank; and

(d) The Chief Executive Officer and each of the administrative divisional officers and plant managers as specified in the staffing plan would be employed under terms and conditions acceptable to the Bank.

4.03 The Chief Executive Officer would prepare a budget that estimates the capital and operating expenditures, including contingencies prior to the beginning of each fiscal year. He would be entitled to transfer, with prior advice to the Minister of EPB, between categories and sub-categories or groups the funds allocated by the budget. The investment line headings would be more or less as given in Annex 7, Table 1. Operation line headings would include a Revolving Fund (para 4.04) and a separate account for the hire-operation of the farm machinery provided by the project.

4.04 The OSPD would receive financing from ROK for its investment and operating budget on an annual basis and for its Revolving Fund on a permanent basis. The Revolving Fund would be used for the procurement of seeds from contract growers and would be credited with the entire proceeds of its seeds sales less distribution expenses. Surpluses, if any, could be used for annual operating expenses including service charges on loans. During negotiations, ROK agreed to finance and maintain the Revolving Fund at the commencement of the fiscal year with not less than the Won equivalent of US$300,000 in 1975, US$1.1 million in 1976, US$4.1 million in 1977 and US$5.4 million in 1978 and thereafter.

Seed Production, Procurement and Processing

4.05 The OSPD would be responsible for implementation of all aspects of the project concerning the production, processing, packaging and distribution of Certified seeds. In this respect the Chief Executive Officer and his administration and operations divisions, with the assistance from domestic and expatriate consultants would design each seed plant, specify equipment, prepare tender documents, evaluate bids and supervise construction of civil works and the installation of equipment. After construction has been completed, the staff would be trained by the suppliers and the consultants in the operation of the seed plants. The budget control division would maintain project investment and operations accounts on a commercial accounting basis.

4.06 The OSPD would contract with a Farmers Land Improvement Association (FLIA), a large cooperative farming organization, at each plant location for the production of predetermined amounts of field crop seeds of the recommended varieties. A typical FLIA operates between 600 and 6,000 ha and has 500 to 5,000 farmer members. Criteria for the selection of each FLIA would include: (a) established perennial irrigation including completed land leveling, installation of field distributaries, drainage and access tracks; (b) soils without major hazards and capable of producing high yields of paddy and barley with double cropping; (c) able management and members willing to perform the cultural practices needed to produce Certified seeds; and (d) located near the plant site. A FLIA with these

characteristics has been tentatively identified at each proposed plant site. The contractual arrangement with the FLIA management would identify the blocks of land and describe the operations agreed to for the production of Certified seeds of the NSC recommended varieties only. Not more than three varieties of any crop would be produced and processed at each seed plant.

4.07 At targeted production the approximate area and quantities required at each seed plant location would be:

	Paddy		Soybeans		Barley		Wheat	
	ha	tons	ha	tons	ha	tons	ha	tons
Pyeongtaeg	715	2,850	310	250	425	850	175	350
Iri	635	2,550	65	50	525	1,050	75	150
Hampyeong	450	1,800	-	-	550	1,100	50	100
Euiseong	575	2,300	250	200	450	900	150	300
Milyang	375	1,500	-	-	550	1,100	50	100
TOTAL	2,750	11,000	625	500	2,500	5,000	500	1,000

4.08 ORD would be responsible for the production and delivery of Registered seed of the recommended varieties to OSPD. The OSPD would provide each FLIA with Registered seed at cost for each variety to be produced. In most cases, the Registered seeds would be produced on the PORD seed farms. The OSPD farm machinery would be available on a hire basis to each FLIA for land preparation, crop dusting and spraying, harvesting and threshing and delivery of seed to the processing plant. The OSPD would assign its Agricultural Officers to work with each FLIA to assure production of high yields of seed that qualify under the standards as Certified seed. The FLIA and its member-seed growers would be paid a premium ranging from 10% to 20% above market price, depending on the crop, for that part of the harvest that met the minimum standards for certification when delivered to the OSPD processing plant. The cost of Registered seed, farm machinery hire and other inputs provided to the FLIA by OSPD would be deducted from the value of the crop.

4.09 The barley and wheat produced by the FLIAs would be delivered to the processing plant after harvest in early June and tested for acceptance. If acceptable, it would then be dried immediately to 12 to 14% moisture and bulk stored in aerated bins until about the middle of August. The seed would then be fine cleaned, treated, packaged and delivered to the NACF wholesale and retail stores early in October on the basis of estimates of demand confirmed by each provincial government. Paddy and soybean would follow this same routine starting with the harvest and threshing in early October and delivery to the wholesalers and retailers by the end of March. Seeds would be packaged in sealed 5 to 30 kg units and labelled as specified by the standards set by NAPIO. Surplus seeds not treated with chemicals could be sold on the consumer market or held in reserve.

4.10 The OSPD would produce Registered seed potato on its farm at Daegwanryeong. This seed would be distributed to its contract seed growers,

all located on farms above 800 m elevation and used for the production of Certified seed. The seed potato would be harvested in October, rough graded and stored before freezing weather begins in early November. Grading, treating and bagging would be performed in late January and February; in time to deliver the seed to the retail sales points by the March to May planting dates.

Seed Distribution

4.11 Prior to each crop planting season the APB and the provincial governments would assist the OSPD determine seed production targets and estimated demand for each recommended variety. The provincial governments with their ORD Rural Guidance staff and other agricultural officers, are fully experienced in contacting farmers for the distribution of seeds and other farm production inputs (para 2.13). Targets would be set for each village, market area, county, district and province for the volume of seeds for each crop to be marketed each crop season. This arrangement produced and distributed over 40,000 tons of seeds in 1970 and 1971 (para 2.18).

4.12 The OSPD would contract with NACF to serve as its major wholesale and retail seeds distributor. NACF would receive the pre-packaged seeds on consignment, arrange for transportation to the wholesale and retail centers, provide the needed transit storage, sell the seed to the farmer-buyer and return the amount collected to OSPD less the costs of marketing. During appraisal, marketing costs were estimated at 5% commission plus the actual cost of transportation and handling - $8.80 per ton for field crop seeds and $10.00 per ton for potato (Annex 11). NACF would also provide short-term production credit if required by the seed purchasers. With about 6,000 retail farm sales and storage centers and with vast experience in marketing farm inputs, commodities and production credit, NACF is eminently qualified to market Certified seeds. The OSPD would also use private retailers and direct sales for the distribution of some of the seeds. During negotiations, assurances were obtained that OSPD would confirm arrangements for seed distribution that would be acceptable to the Bank.

C. The National Seeds Council (NSC)

4.13 The NSC would serve as an advisory agency to the MAF on national policies regarding the seeds industry. The NSC, as currently organized, does not adequately represent all of the interests that should be involved in framing national seeds policy. Its membership would be revised to include the MAF Vice Minister as Chairman and representation from OSPD, ORD, APB, NACF, NAPIO, COA, provincial governments and seed marketers. Standing committees, with technically qualified members, would deal with: (a) the addition of new seed varieties and the removal of superseded varieties from the recommended lists; (b) seed marketing standards and practices; and (c) the import and export of seeds. During negotiations assurances were obtained that the NSC would be reorganized and activated under terms of reference acceptable to the Bank. The proposed terms of reference are given in Annex 6.

D. NAPIO and Quality Control

4.14 The NAPIO is responsible for the enforcement of the provisions relating to quality control in the Seed Law of Staple Crops (Law No. 975) of January 16, 1962 as amended. It has not been active in the certification of field crop seeds under the existing program partly because of defects in the Law. The Seeds Law would be revised to ensure that NAPIO had the authority to inspect fields of crops produced for seed and seeds in storage or retail establishments; take samples and test seeds offered for sale, license and regulate seed dealers; and assure farmers that seeds offered for sale meet minimum quality standards as labeled (Annex 5). During negotiations, assurances were obtained that (a) the Seeds Law and attendant regulations would be modified and strengthened within 18 months of Loan effectiveness under terms acceptable to the Bank; (b) all seeds offered for sale in the ROK would meet quality standards set by the Seeds Law and its regulations; and, (c) OSPD would produce and market only seeds of varieties recommended by NSC and inspected by NAPIO.

E. Seed Prices and Financial Responsibilities

4.15 During the 30 year estimated life of the project, the OSPD would recover its costs; i.e. administration and overhead, procurement, processing, storage, distribution, plant repair and maintenance and loan service charges; from the sale of seeds. Its costs for Registered seed and for farm machinery operations would be recovered from seed growers. Fees paid NAPIO would cover its investment and operating costs for the certification of project seeds. Estimated operating costs are detailed in Annex 11.

4.16 To recover the above costs as estimated at 1972 prices, it would be necessary to price the field crop Certified seeds to farmers at an average margin of 65% above and seed potato at 160% above the 1972 crop harvest prices. In the existing program field crop seeds have been priced at 20% above grain harvest prices for average quality seeds and as high as 100% above for Registered seed and seed of new varieties. Seed potato is usually sold with a margin 100% or more above the harvest price. At these prices, ROK absorbs a loss of about US$1.0 million per year; US$20.00 per ton of seed for the payment of seed growers premiums and US$5.00 per ton for seed promotion activities. With the project all of the seed grower premium costs and a part of the seed promotion costs would be assumed by the OSPD.

4.17 Korean farmers may not be willing to purchase the available supply of project seeds at 65% or 160% above harvest prices for the first three or four years until their higher quality has been proven and accepted. Pricing seeds at an average mark-up of say 40% for field crops and 120% for seed potato in the first year of operations (1975 for potato and 1976 for field crops) and gradually increasing the mark-up to cover all costs by 1979 would be acceptable. Losses accruing during this time would be less than US$1.0 million and would be met from OSPD's annual budget. ROK and the respective provinces would transfer their support from the existing seeds

program to OSPD and the other participating agencies; the existing program of providing Registered seed to village seed growers would be discontinued. During negotiations assurances were obtained on these matters.

4.18 However, during the 30-year life of the project, OSPD's operating costs would be sensitive to harvest prices, premium arrangements contracted with the FLIA Certified Seed growers, deviations from the projected volumes and other factors. Accordingly, seed prices as calculated above may not be the appropriate prices to charge farmer-users of the OSPD Certified seeds. OSPD would determine the sales price for each type of seed each year to reflect changes in costs, the value of crop yield responses obtained from the use of Certified seeds, the introduction of new varieties, competitive prices and reliability of seeds available from other sources and other market factors. As a general rule, OSPD would be responsible for setting the retail prices for its seeds. However, for national policy reasons the ROK may decide to regulate these prices at levels below costs. During negotiations, assurances were obtained from ROK that: (a) the OSPD would initiate and continue operational research studies designed to (i) evaluate demand for each type and variety of seed to be produced each year; (ii) calculate costs; and (iii) determine seed prices that would be sufficient to recover all costs including plant replacement and loan servicing charges during the life of the project; and (b) to the extent that ROK regulates seed prices at below costs, ROK would reimburse the OSPD Revolving Fund as needed.

F. Accounts and Audits

4.19 Separate accounts would be established and maintained to cover each part of the project investment and operations. OSPD's accounts would be maintained so as to reflect in accordance with sound commercial accounting practices, its operations and financial conditions. Assurances were obtained during negotiations that (a) each separate account would be maintained as indicated above and audited annually by an independent auditor acceptable to the Bank; and (b) copies of the audit reports would be sent to the Bank within four months after the close of each fiscal year.

V. BENEFITS AND JUSTIFICATION

5.01 Economic Benefits: At full development, Certified seeds marketed would be sufficient to sow about 300,000 ha of paddy, 40,000 ha of regular barley and 40,000 ha of naked barley, 18,000 ha of wheat, 9,000 ha of soybeans and 11,000 ha of potato. Estimated increased yields due to improved seeds, based on ORD research, would be 6% for paddy, 12% for barley and wheat, 10% for soybeans and 50% for potato. The value of this increase when priced at estimated 1980 world market prices would provide a national gross incremental annual income of about US$14.0 million (Won 5,600 million). After deducting the investment costs (exclusive of

price contingencies) and the operating costs, the economic rate of return would be about 48%, without potato the ERR is 37%. If the estimated increased yield were reduced by half, the rate of return would be about 23%. A 15% higher cost and a 25% lower sales volume provides an ERR of 33%.

5.02 The saving in foreign exchange that would result from the substitution of the increased grain, oilseed and potato production for equivalent imports of these items would be the import cost of 80,000 tons of foodgrains, 7,500 tons of oilseeds and 60,000 tons of potato valued at about US$14.0 million annually. The project would have a minimal direct employment effect.

5.03 Financial Benefits: The estimated net incremental farm income per ha accruing to farmer-users of Certified seed in the year the seed is used would be about US$45 for paddy, US$29 for regular barley, US$34 for naked barley, US$25 for wheat, US$9 for soybean and US$250 for potato. These direct benefits would accrue to at least 500,000 farm families, about one-fifth of the farmers in Korea. More than 400,000 ha of land would be planted with the new seeds each year. Without seed renewal, benefits would continue at a decreasing rate for the next three to five years except for potato which requires new seed each year. FLIA members growing Certified seed for OSPD would receive higher net farm incomes because of the supervision and seed grower premiums provided by the OSPD. However, these benefits would be limited to about 5,000 farmers and the 77,000 ha of land needed to produce the seed.

5.04 Ecology: It is unlikely that the project would significantly alter the ecology of the area. In Korea, field crops and potato are generally protected from pests and diseases by chemical sprays. With the project, there would be very little, if any, change in the rate of application.

VI. AGREEMENTS REACHED AND RECOMMENDATIONS

6.01 During negotiations agreement was reached on the following principal points:

(a) The Seed Law for Staple Crops (Law No. 975) would be amended and regulations modified to establish the OSPD within 12 months from the date of loan effectiveness. No disbursement would be made, except for consultants, until the above conditions had been fulfilled; the Chief Executive Officer posted would be acceptable to the Bank; and the Chief Executive Officer and each of the administrative divisional officers and plant managers as specified in the staffing plan would be employed under terms and conditions acceptable to the Bank (para 4.02);

(b) OSPD would be financed adequately with annual appropriations for operating expenses and a Revolving Fund equal to or greater than the cost of seed procurement (para 4.04);

(c) The OSPD would initiate and continue operational research studies designed to evaluate demand for each type and variety of seed to be procured each year, calculate costs and determine seed prices that would recover all costs including plant replacement and loan service charges (para 4.18); and

(d) The Seeds Law and its regulations would be revised to strengthen the NSC and NAPIO (paras 4.13 and 4.14).

6.02 A condition of loan effectiveness would be that arrangement acceptable to the Bank had been completed with USAID for the financing of additional crops research for ORD.

6.03 The project is suitable for a loan of US$7.0 million under standard Bank terms.

September 25, 1973

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

AGRICULTURE AND THE ECONOMY

General

1. Agriculture plays a major role in the economy of Korea. It employs almost half of the total labor force, accounts for nearly 30% of GNP, and provides raw materials for a large share of Korea's dynamic industrial sector. Agriculture's importance in the economy as measured by its share of total employment, GNP, and total exports has declined in the last decade. Agricultural production has not kept pace with growing market requirements, especially for food grains, causing the trade deficit for agricultural products to rise from US$64 million in 1961 to US$362 million in 1971. Income gains of rural people have lagged far behind those of urban people. Despite a large migration from rural to urban areas, real incomes of farm households increased about 60% from 1961 to 1971 while those of urban households more than doubled.

2. During the first and second five-year plan periods (1962-1966 and 1967-71), rapid industrial growth was the major objective of Korea's development strategy and the urban industrial sector absorbed the lion's share of investment resources. Manufacturing output rose 20% annually and industrial exports 40% annually. Output of the agricultural sector, including forestry and fishery, which received only about 6% of total public investment during the first two plan periods increased 4% annually. Korea now has decided to put greater emphasis on agriculture and rural development. Major objectives of the new development strategy are: (a) to achieve a more equitable income distribution and improve rural infrastructure to meet social needs, (b) to accelerate expansion in food grain production and in particular attain greater self-sufficiency in rice production, and (c) to conserve and develop land and water resources to build up the resource base for expanding agricultural output in the future.

3. Nearly 70% of the land area is hilly or mountainous. Cultivated land, about 23% of the total, is located mainly in river valleys and along the western and southwestern coasts. Temperatures limit the growing of winter crops in the northern part of the country but not in the south. Rainfall averages between 1,000 and 1,250 mm a year, but over half falls during June to September. Rainfall fluctuates widely from year to year causing severe flood damage in some years and water shortages for irrigation and seed production in others. See IBRD Map 10376.

4. Korea has only .07 ha of cultivated land per person. As shown below, almost 60% of the 1971 cultivated area was in paddy. Other crops include barley, wheat, maize, forage, fruits and vegetables and potato.

	Million ha.	Ha. per person
Cultivated area	2.3	.07
paddy	(1.3)	(.04)
upland crops	(1.0)	(.03)
Forests	6.7	.21
Waste and other land	.9	.03
Total	9.9	.31

The crop area, production and yield data by provinces are given in Table 1.

5. Major constraints to expanding crop production include low native fertility and high acidity of soils which therefore require large applications of fertilizer and lime to be productive, highly variable rainfall which often causes water shortages during rice planting periods in June and flood damage from August to October and poorly developed irrigation and drainage facilities which together with low temperatures prevent double cropping of much cultivated land. However, Korea has nearly one million hectares of sloping land that could be developed for orchards, pasture, upland crops and forestry production.

6. Nearly 15 million people, almost half of the nation's total, live in about 35,000 rural villages. There are 2.5 million farm households. Land holdings per household are small and highly fragmented. They averaged only 0.9 ha per household in 1970, including 0.5 ha of paddy land and 0.4 ha of dry fields. Each farm household usually has land in several small plots at different locations which makes mechanization difficult. As a result of land reform carried out after World War II, almost all farm land now is owner operated. Farm households receive about 20% of their income from off-farm employment. There has been little change in total farm population or in the average size of land holdings in the last decade. However, about 4.5 million people have moved from rural to urban areas since 1961, a number equal to about one-third of the urban population in 1971. As a result, urban population almost doubled in the last decade. Population growth declined from 2.5% annually in the early 1960s to 1.8% in 1971.

7. Korea's overall agricultural output grew at a rate of 3.5% annually during 1961-71. Total crop production increased 3.4% annually; the planted area increased about 1% annually and crop output per hectare 2.4%. Production of fruit, vegetables, and industrial crops more than doubled as both yields per hectare and planted areas of these crops increased greatly. However, rice production which accounts for almost half

of the total value of crop production increased only about 2.6% annually. There has been little change in the planted area of rice and other food grains. New land developed for paddy has been offset by reduction in paddy land due to expansion of cities, highways and industries. Total cultivated area increased about 240,000 ha (12%) in the last decade mainly by bringing additional upland under cultivation. Cropping intensity has averaged about 150% annually and has not changed in the last decade.

8. It is mostly in relation to growing domestic demand for food grains and livestock products that agriculture's production performance can be considered inadequate. By contrast, fruit, vegetables, and fishery exports have increased. Imports of rice, wheat and barley increased to 2.7 million metric tons in 1971 (about 45% of local production) compared with only 500,000 to 600,000 tons in the early 1960s. Rising food and feed grain imports are mainly responsible for Korea's growing trade deficit in agricultural products. Export earnings from fruit, vegetable, fishery and other agricultural products increased to US$85 million in 1971. This growth was not enough to offset the rise in agricultural imports from US$44 million in 1961 to US$414 million in 1971.

9. Capital Inputs: The National Agricultural Cooperative Federation (NACF), a semi-autonomous government agency, has a monopoly on the sale of fertilizer but private firms in addition to NACF sell other inputs and carry out marketing functions. Korea maintains low prices for fertilizer and subsidizes purchases of farm machinery. Fertilizer prices paid by farmers have not increased since 1965 and now cover only 40% of the cost of manufacture and delivery. Fertilizer production as well as use by farmers has been subsidized. Fertilizer use increased from 308,000 metric tons (plant nutrients) in 1961 to over 600,000 tons in 1971. The number of power tillers increased from only 30 in 1961 to over 17,000 in 1971. There also have been large increases in numbers of power sprayers, threshers, and other farm machines. Use of fungicides, insecticides, herbicides and other chemicals to control insect pests and diseases increased from 5,000 tons in 1961 to over 17,000 in 1971.

10. Land and Water Development: The Agricultural Development Corporation (ADC) is chiefly responsible for carrying out irrigation projects. Because of the extreme shortage of land suitable for cultivation and possibilities of increasing crop production by improving irrigation, drainage and flood control facilities the Government has made large investments for land and water development. Government investments for water development averaged between 2 and 3 billion Won annually during 1965-68 and increased to 18 billion in 1969 and 14 billion in 1970. About two-thirds of the paddy, barley and wheat lands are irrigated.

11. Price Supports: Government price support programs for barley, soybeans, maize and other crops have been carried out by the MAF to encourage output expansion and to improve farm incomes. Producer prices for rice and other grains were near those at which imports were available in 1965, but the government support price for rice was raised each year until it reached US$242 per metric ton in 1972, about 50% above the import price of US$166 a ton. Producer support prices for polished barley have

been at 67% of those for rice, but the retail price of barley has been maintained at 50% of that for rice in order to encourage consumption substitution of barley for rice. Livestock product prices also have been maintained at high levels to encourage increased production. Imports of livestock products were restricted beginning in July 1972. Consequently, price relationships among farm products generally are similar to those in world markets except that prices of most fruits and vegetables are relatively low. Real incomes per farm household have increased since 1965 largely as the result of higher farm product prices. However, rice production has not increased significantly indicating that other measures such as improved water management, new high yielding varieties, and better disease and pest control practices may be required to expand rice production. But a significant increase in production of other grains, 33% from 1961 to 1971, was achieved.

12. Agricultural Credit: The government sponsored cooperative system, National Agricultural Cooperative Federation (NACF), is the main source of institutional credit. Interest rates for NACF credit range from 3.5% for long term irrigation loans to 15.5% for certain kinds of medium term production and facility loans. The largest volume of loans is at 9%. These rates may be compared with Korean Development Bank industrial loans ranging from 7.5 to 16.5% and commercial bank rates mainly in the 6 to 15.5% range. Farmers get most of their credit from non-institutional sources at rates of 4 to 6% per month. Loans available in the cooperative system from the government budget and from its own banking operations fall far short of meeting the demand at the terms offered so rationing of available credit by NACF is necessary. There are no good estimates of aggregate credit needs of farmers, but lack of credit has not retarded growth in the use of fertilizers or pesticides. However, lack of intermediate term credit probably has retarded mechanization and expansion of livestock production. It is reported that 80% of the loan applications made by farmers to NACF to help finance the use of farm machinery in 1972 had to be rejected because of lack of government loan funds.

The Ministry of Agriculture and Fisheries (MAF)

13. The MAF effectively supervises all agricultural services in the country. Each provincial government has an Agriculture and Forestry Bureau which administers MAF functions in the province. The MAF is concerned with overall policy formulation, budgeting, programming and coordination. It recommends appointments to senior provincial administrative positions at the central and gun (county) levels, but the rest of agricultural staffing and the day-to-day administration of all officers and activities within the province is the responsibility of the provincial administration.

Agricultural Extension

14. Agricultural extension work in Korea is highly developed. It is elaborate and well coordinated. Technical guidance and training is given by the Office of Rural Development (ORD) which disseminates the results of its research through about 75 workers of ORD, 260 workers at the Provincial Offices of Rural Development (PORD), about 6,500 Rural Guidance workers in the

1972 guns (county) and 15,000 agricultural workers and farmer leaders. The agriculture and forestry sector workers located at the gun and myon (sub-county) levels are responsible for implementing the programs of MAF, which are channelled through the Agriculture and Forestry Bureau of the provincial government.

15. County Extension Setup: The gun administrative chief in consultation with his agricultural sector workers and Rural Guidance Officers prepares detailed breakdown of MAF and provincial government programs for myons, ri or dongs (Group of 2-4 villages) and villages within the gun. To illustrate the organizational set up for implementation of agricultural programs in a gun the position in Hampyong gun of the Cholla Nam province may be examined. This Hampyong gun with a total area of 385 sq km is one of 22 guns in the Cholla Nam province. It has 9 myongs, 104 dong and ri and 478 villages. There are 19,500 farm households cultivating about 17,500 ha. There are altogether 150 workers who are concerned with agricultural extension work in one way or another giving an average coverage of 130 farm households or 120 ha per worker. This includes 33 Rural Guidance Officers and 22 agricultural and forestry sector workers at the gun level, 54 agricultural and forestry sector extension workers at the myon level and 51 leaders of Prosperity Zones who receive some salary from government. In addition, each dong or ri leader has one trained farmer each for seeds, fungicide, insecticide, fertilizer, and irrigation and drainage. The gun administrative chief directs and coordinates the activities of these workers, who may be assigned either on functional or regional basis. A typical Organization Chart for a province is attached.

16. Cooperative Rice Production Zones: As a means of increasing rice production, a cooperative system was introduced since 1968. Under this system, farmers are organized into cooperative zones covering 5 to 15 ha and urged to use the same paddy variety and the same cultural technology, fertilizer application and insect and disease control methods. Leaders are specifically selected, a farmers council is designated in each area, training sessions of farmers are activated during the winter months, and pamphlets and cultivation calendars are printed and distributed to all the farm households. This system was used to increase the area under Tongil paddy (IR-667) from nothing to 200,000 ha in 1972. Over 640,000 farmers were organized into 20,000 cooperative paddy production zones and given training by Rural Guidance Officers with supporting pamplets and cultivation calendars. The effectiveness of this system is evidenced by the success of the Tongil paddy program.

17. Cooperative System for Inputs, Credit and Market: Again, the distribution of almost all supplies of inputs and credit originating from Government resources are managed through the cooperative system which also handles marketing of a number of crops. About 90% of Korean farmers are members of cooperatives. The dong-ri cooperatives which may cover from 2 to 5 villages are primary societies grouped into gun agricultural cooperative federations, and successively into provincial and the National Agricultural Cooperative Federation (NACF).

18. Package Approach: The development program for increased production of crops particularly in respect of the use of recommended seeds and other inputs is planned and implemented as a package approach. The Agricultural Extension Service is well coordinated with other programs that make available the necessary inputs. Accordingly, the mission is satisfied that the Agricultural Extension and Cooperative systems in Korea are adequate to promote the production, distribution and utilization of improved agricultural inputs. They would be used to determine demand for and distribute seeds by the proposed project.

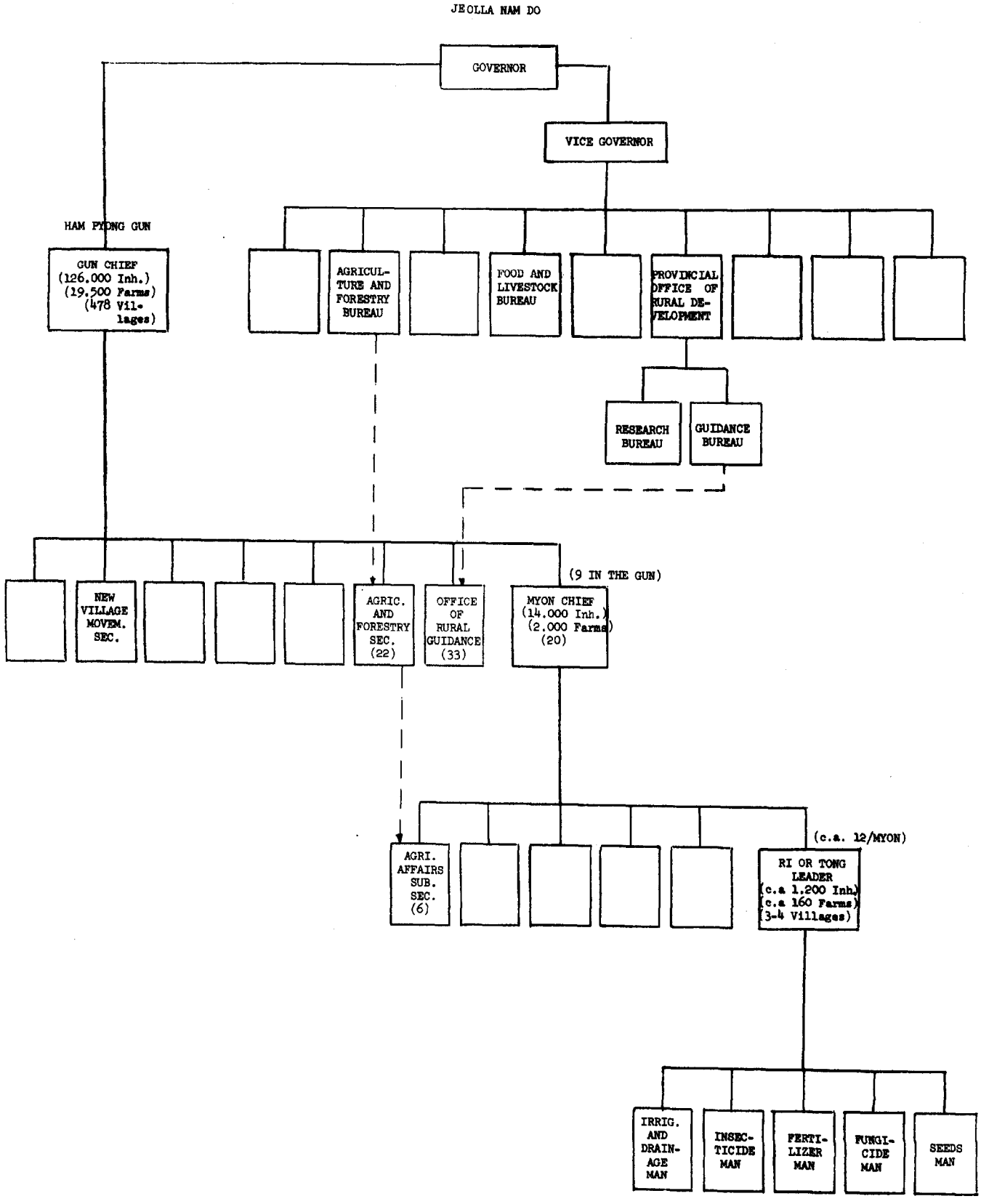
July 25, 1973

REPUBLIC OF KOREA

ANNEX 1
Chart 1

KOREAN SEEDS PROJECT

ILLUSTRATION OF ORGANIZATIONAL SET UP FOR AGRICULTURAL RESEARCH EXTENSION AND DEVELOPMENT IN THE PROVINCIAL ADMINISTRATION AT DIFFERENT LEVELS



REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

Crop Area, Production and Yield by Provinces
(Average of 1967-71)

Annex 1
Table 1

Crop	Gyeong Gi	Gang Weon Do	Chung Chong Puk Do	Chung Chong Nam Do	Cholla Puk Do	Cholla Nam Do	Kyong Sang Puk Do	Kyong Sang Nam Do	Cheju Do	Seoul and Pusan	TOTAL
Paddy											
Area 000 ha.	173	53	74	167	166	197	195	163	3	9	1,200
5 Yr. Prod. 000 tons	780	190	302	814	728	813	855	708	5	34	5,229
Average yield t/ha.	4.5	3.6	4.0	4.9	4.4	4.1	4.4	4.3	1.7	3.8	4.3
Regular Barley											
Area 000 ha.	39	15	49	47	6	1	173	106	5	1	442
Prod. 000 tons	86	31	138	130	13	3	447	307	11	2	1168
Average yield t/ha.	2.2	2.1	2.8	2.8	2.2	2.6	2.6	2.9	2.2	2	2.6
Naked Barley											
Area 000 ha.	3	-	2	40	118	228	11	57	22	1	482
Prod. 000 tons	5	-	4	100	287	674	23	182	51	2	1328
Average yield t/ha.	1.8	-	2.2	2.5	2.4	2.9	2.1	3.2	2.3	2	2.7
Wheat											
Area 000 ha.	12	9	17	17	16	25	36	21	-	-	153
Prod. 000 tons	26	17	38	39	33	58	75	53	-	-	339
Average yield t/ha.	2.2	1.9	2.2	2.3	2.1	2.3	2.1	2.5	-	-	2.2
Soybean											
Area 000 ha.	40	29	30	48	25	35	60	24	8	-	299
Prod. 000 tons	27	27	26	38	18	21	47	17	5	-	226
Average yield t/ha.	0.7	0.9	0.8	0.8	0.7	0.6	0.8	0.7	0.6	-	0.8
Potato (White)											
Area 000 ha.	6	15	6	3	5	3	12	6	-	-	56
Production 000 tons	68	175	64	32	53	31	108	59	2	3	595
Average yield t/ha.	11.3	11.6	10.7	10.6	10.6	10.3	9	9.8	-	-	10.6

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

THE EXISTING SEEDS INDUSTRY

1. The MAF through APB, ORD and the provincial governments has organized and operated a large scale public sector seeds production and distribution industry for cereal crops, soybeans and potato for several years. A National Seeds Council, with representation from the MAF, ORD and the Colleges of Agriculture, recommends the varieties to be propagated and seed production targets for each province. The system is designed to enable farmers to renew their seed from official sources every third year for paddy, barley, wheat and potato and every sixth year for soybeans.

2. ORD multiplies the Breeder and Foundation seeds of these varieties and provides Foundation seeds to the provincial seed farms (PORD). The next stage, Registered seed, is produced on the PORD seed farms and distributed by the respective provincial governments to many thousands of selected seed growers in selected villages for reproduction as "Certified" seed. Typically, the provincial government's county and village staff are allocated target areas and quantities of seed to produce. A small group of progressive farmers with adjacent lands are organized into a Prosperity Zone (PZ) group. The Registered seed stock together with fertilizers, plant protection services and field rogueing services are provided this group in an attempt to maximize output and maintain quality. Each PZ seed-grower farmer harvests his crop and, on demand, "spontaneously" exchanges his seed for commercial grain with other farmers. The PZ seed growers receive an incentive payment from government, usually at 20% above the market price of the grain at harvest. In addition, the seed grower may negotiate a premium price from his customers. Prices up to 100% above harvest prices were reported for the new Tongil paddy variety.

3. Seed production under the system for 1969-71 was estimated as follows:

	Total Crop Area	Seed Rate Kgs/per ha	Seed Requirements	Amount of Seeds Produced and Distributed		
				1969	1970	1971
	M. Ha.		thousand tons			
Paddy	1.2	40	48	6.7	10.3	22.0
Barley	.92	65	60	17.0	16.4	13.7
Wheat	.15	55	8.4	2.5	4.2	3.9
Soybeans	.30	55	16.5	1.3	2.1	1.0
W. Potato	.06	1,000	60	n.a.	7.7	6.0

4. Arrangements and procedures for the production of Breeder seed are under the control of the plant breeders located at Suweon or at one of the Regional ORD Crop Experiment Stations at Honan and Milyang for field crops and at Alpine for potato. For paddy, ear rows are transplanted, with only rows true to the plant type being bulked and harvested for seed. Similar procedures are followed at the PORD seed farms where the the Foundation and Registered seeds are produced. In most cases, atypical plants are destroyed before harvest. The plant breeder usually inspects the crop and determines if it meets his standards.

5. The PORD seed farms, inspected by the mission at each proposed plant site, appeared to be under adequate managerial control and adapted for the purpose of producing seed stock. They were provided with vermin-proof storage buildings and farm machinery, seed threshing, cleaning and drying equipment. However, most of these farms needed additional equipment for the purpose of producing Registered seed under the project. The PORD seed farm areas available for the production of Foundation and Breeder seeds are as follows:

Plant Location	PORD Seed Farm		Crops Produced
	Farm Location	Area ha.	
Pyeongtaeg	Suweon	Paddy 30 Upland 7	Field Crops
Iri	Iri	Paddy 40 Upland 10	" "
Hampyeong	Songjedngri	Paddy 40 Upland 11	" "
Milyang	Milyang	Paddy 20 Upland 8	" "
Euiseong	Chilgok	Paddy 29 Upland 8	" "
Daegwanryeong	Daegwanryeong	450	Seed Potato

6. Provision for the supervision and quality control of Foundation and Registered seed production by the National Seeds Council is clearly adequate and the genetic quality of each variety is maintained, although admixtures after harvest is possible. No grow-on trials are undertaken to check quality. The seed is tested for purity and germination at poorly equipped ORD Experiment Station seed laboratories. NAPIO does not inspect the crop in the field, nor process seed samples in its laboratory.

7. The PZ selected farmers who receive Registered seed from the PORD farm, multiply this seed into "certified" seed under the supervision of the PORD Rural Guidance Officer (PRGO). Fields may or may not be rogued to remove a typical plants, other crops and weeds. The farmer who is responsible

for harvesting, drying, cleaning, packaging and distribution uses traditional methods; the same way he prepares commercial grain for marketing. There is no field inspection for paddy and only limited laboratory testing for purity and germination by NAPIO or any other agency. The provincial government staff interviewed by the mission considered the NAPIO standards to be unrealistically high and inflexible. Neither NAPIO, nor the provincial agricultural agencies have the trained staff, ability or equipment needed to classify the PZ produced seeds as to quality.

8. The failure to use appropriate methods for maintaining species and varietal purity in the PZ seed grower scattered fields and for harvesting, threshing, drying, processing, storage, treating for seed borne diseases and packaging results in seeds with variable quality and low yield improving potential. As a result, farmers have not demanded the PZ "certified" seed. A considerable proportion of the production has been used for food consumption rather than seed.

9. Deficiencies of the existing system which the proposed project would be designed to correct include the following:

(a) The PORD seed farms, under the control of the provincial governments are also used to produce varieties not recommended by the MAF-NSC. These ad hoc varieties have a low demand from farmers, contribute to the varietal mixture problem and fail to increase crop yield. With the project, only varieties recommended by the MAF would be multiplied as Foundation and Registered seed on the PORD seed farms.

(b) Purity and high germination cannot be assured when seed production areas are small, scattered, lack technical supervision and use traditional methods for harvesting, threshing, drying, storage and packaging. The proposed project would provide for a concentrated system of seed production under the supervision of technically competent staff, equipped with modern facilities for production, harvesting, threshing, drying, storage, cleaning, treating, packaging and distribution of seeds meeting Certification standards. NAPIO would have full responsibility for field and seed inspection, appropriate labeling and compliance with the Seeds Law and its regulations.

(c) Seed borne diseases are not identified and controlled. All seeds produced and marketed by the KNSC would meet acceptable standards for seed borne diseases.

(d) The existing program provides for a modest input of new varieties as developed by the COA and ORD plant breeders. The proposed project's parallel financing by USAID would strengthen ORC in an attempt to increase the flow of improved higher yielding varieties. The project provides the means for a more rapid multiplication and distribution of the recommended varieties.

(e) Over all direct recurrent costs to the MAF and provincial governments for the existing seed program exceeds US$1.0 million per year or about US$25.00 per ton of seed targeted. None of this expenditure is recovered by government from seed buyers. The proposed project at full development would be self-sufficient and recover all costs of operation including loan servicing.

July 25, 1973

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

THE OFFICE FOR RURAL DEVELOPMENT (ORD)

A. General

1. The ORD Research Bureau has the responsibility for varietal improvement research in field crops, i.e. paddy, barley, wheat, maize, oilseeds, forage and pasture crops and potato. A program coordination office is located at Seoul in the MAF. The main research center in all crops other than potato is located at the Suweon Crop Experiment Station in Korea's northern ecological zone. An important role is played, notably in paddy, barley and wheat improvement, by the Honam Station in the central ecological zone, and by the Milyang station in the south ecological zone. Potato research is performed at the Alpine Experiment Station. Provincial Offices of Rural Development located in each province conduct adaptive and associated cultural research at the PORD research seed farms and adaptation trials on farmers' fields throughout the country. ORD encompasses a Program Coordination Office and the Bureau for Research and Rural Guidance which are situated in Seoul. In addition research institutes are located as follows:

- Veterinary Research Laboratory - Anjang
- Institute of Plant Environment - Suweon
- Crops Experiment Station - Suweon
- Horticulture Experiment Station - Suweon
- Sericulture Experiment Station - Suweon
- Livestock Experiment Station - Suweon
- Honam Crops Experiment Station
- Jeju Experiment Station
- Alpine Experiment Station - Gang Neung
- Yungnam Crops Experiment Station

2. Staff: In 1972, the ORD staffing was as follows:

	ORD	PORD	RGO	Total
Administrative Officers	105	115	-	222
Research Workers	493	307	-	800
Guidance Workers - Extension	73	256	5,759	6,088
Miscellaneous Services	118	167	-	285
Total	791	845	5,759	7,395

3. Paddy research is by far the most active and strongly supported program, though there has been considerable recent advance in other programs and further intensification is planned. The physical facilities provided, especially for paddy, are generally good. Paddy breeders can handle up to three generations of breeding material every year. Scientists assigned to crop breeding are as follows: paddy, 27; barley and wheat, 12; oilseeds, 3; maize, 2; potato, 3; and forage crops, 2.

4. Research programs are handicapped by inadequate staffing - both in numbers and standards - and by inappropriate organization. Breeders engaged in crop improvement lack the support of essential related disciplines - notably pathology, entomology, and cereal chemistry. The more basic breeding work in paddy, barley, wheat and soybean is conducted at Suweon with the other centers working on more specific problems, e.g., resistance in paddy to brown hopper concentrated at Honam and resistance to dwarf virus at Milyang. It should be noted that in the College of Agriculture - Suweon National University (COA/SNU) - the Department of Crop Science (2 PhDs and 2 MS) paddy improvement program is supported by well staffed departments of pathology, entomology and physiology all of which are involved in plant breeding. There is a weak relationship with ORD due to lack of coordination, though there is temporary use of COA/SNU breeders as was seen in the development of the new Tongil variety.

5. Paddy: Paddy crop improvement research in ROK followed this pattern:

- 1907 - mid 1940s - introduction of varieties from Japan; potential yields were raised by 3.3 to 5.0 tons paddy per ha. New introductions dominated rice area in a ratio of about 3:1.
- 1947 - Establishment of Institute of Agriculture Improvement at Suweon.
- 1962 - Institute incorporated into ORD.
- 1968 - ORD in association with COA/SNU had developed 21 recommended varieties that had been tested through a network of regional and provincial experiment farms, and farmer field sites and with a potential yield of 6.5 tons/ha. They are sown on 65% of the area planted in paddy.
- 1965 - Breeding program started in collaboration with IRRI in the Philippines to develop the Japonica and Indica cross. IR 667 - Tongil was the outcome which has a potential yield of 8.3 tons/ha.

6. Three generations can be produced per years with line selections from P3 being given preliminary yield trials for two years, followed by two years of advanced yield trials including agronomic testing. Up to this stage all work is supervised by plant breeders and retained at the three experiment stations. The breeding program is now making considerable progress in developing new IR 667 related lines by back-crossing to standard Korean varieties aimed at correcting Tongil's deficiencies, e.g. susceptibility to cold and insect attack. Results of this work are expected to emerge in 1974/75. The new variety would be multiplied and distributed by the proposed project.

7. A special seeds program to multiply Tongil resulted in 12,500 tons being produced and distributed in 1972. The success of this program was assured by the considerable administrative and extension effort by ORD and special incentives to selected seed growers. The farmers interest in the variety created by widespread publicity was such that premiums of up to 100% were paid for "pre-general release" seed. Farmers planted over 200,000 ha or about 20% of the paddy area with this variety.

8. In 1972, the MAF recommended six varieties of paddy as listed below: Nongback (released 1969); Jinheung (1962); Man Kyung (1969); Palkweng (1964); Akibore (1971); Tongil (1971). These varieties cover the full ecological adaptation range and an adequate maturity range. All varieties, except Tongil, have yield potentials for paddy of around 6.5 tons/ha. Tongil, developed by the COA, has produced average yields of 7.0 to 10.0 tons/ha in trials on almost 5,000 farms throughout the country.

9. Barley and Wheat: Current emphasis in ROK is on double cropping patterns to intensify agricultural production. The main need is for early maturing high yielding varieties together with disease resistance and acceptable grain size and milling quality. For example, winter barley and wheat are sown after paddy harvest in October and harvested before paddy is transplanted the following June. Since paddy is the most profitable crop, the highest standards of husbandry are accorded it; therefore, barley and wheat crops must be harvested by mid-June. This problem is less important in the southern regions where farmers have a larger growing season in which to operate.

10. Plant improvement work on barley and wheat started around 1909 with local varieties then having yield potential of around 2.4 tons/ha. Potential productivity levels of the best improved varieties have been raised to 6.2 tons/ha for regular barley, 5.0 tons/ha for naked barley and 4.7 tons/ha for wheat. These improved varieties account for 40 to 60% of the sown areas. In the naked form the grain is huskless (the caryopsis is without lemma or palea), it is grown mainly in the central and southern parts of ROK.

11. Breeding work is undertaken at the three regional experiment stations with Kwangju (branch station of Honam) being responsible for work on naked barley. Plant improvement is attempted by crossing selections from spring wheat to introduce earliness in winter wheat and in the case of barley and wheat to incorporate desirable characteristics from within existing germ plasm in ROK and from geographically remote areas e.g. from Europe. There

are three recommended varieties of regular and two of naked barley, most of which are old introductions. Korean releases since 1965 occupied something less than 20% of the total area cropped to barley in 1971. However, breeding research has developed a new barley variety which matures 5 days earlier and has a yield increase of 15 to 20% over other varieties. It is adapted to paddy land as a double crop. It would probably be available for seed multiplication by 1975. For wheat, two varieties are recommended.

12. Soybean: In 1913, potential yield levels were around 1 ton/ha. Crop improvement work started then showed no real improvement until the 1960s when the use of introduced varieties raised potential yields to around 1.6 tons/ha. Locally developed new varieties raised this to around 2.1 tons/ha and in 1970, 55% of the national soybean area was sown to new varieties. There are 13 recommended varieties. Breeding policy is to improve existing varieties with regard to oil and protein content, disease and insect resistance, and improved growth characteristics.

13. Potato: Local varieties have been grown in Korea for a long time. The first foreign introduction, Nankok from Germany, was in 1920. From 1945-1960, a number of new varieties from the U.S.A. were introduced, including Irish Cobbler, which is now grown on 80% of the potato cultivated area. A breeding program was started in 1965 using characteristics in wild varieties on existing material to produce early maturity, high yield, disease resistance and high starch content. From 1965 to 1971, 98 hybrids have been tested and nine promising lines are undergoing yield and agronomic trials. The breeding work is carried out on the Alpine Research Station in Gang Weon province where Foundation seed is produced. Current yield potential is 15 tons/ha whereas breeding targets plan to achieve 20 tons/ha. Lines from Irish Cobbler crossed with Mary Baker look favorable for release around 1975 and 1976. A number of other promising lines are undergoing tests.

14. Crop Breeding Problem. The overall breeding program is dominated by the necessity to find varieties that fit the dominant climatic factors shown diagramatically in Figure 1. The main problems are listed as the need to:

(a) develop cold tolerance in barley and wheat against the possibility of damage during germination and early growth from below-average cold conditions throughout the winter;

(b) develop resistance against disease patterns favored by high temperature and high humidity during heading of wheat and barley in May when rainfall is heavy;

(c) seek early maturity in wheat and barley so that:

(i) harvesting and associated operations in June will not be overly affected by above average rainfalls, and

(ii) peak labor demands due to the need for rapid turnaround of crops when double cropping with paddy, soybean and other crops are reduced;

(d) develop delayed flowering in the paddy crop so that it continues to grow vegetatively during the main rainy period of July and August and yet matures sufficiently rapidly afterwards to avoid cold damage from rapid temperature drops experienced in late September and early October;

(e) develop new higher yielding varieties of potato which are faster in the tuber setting and more vigorous under low temperatures at the early growing stage; and

(f) breed for disease resistance in all crops, particularly virus in potato.

B. The National Seeds Council (NSC)

15. The NSC includes representatives from MAF, ORD, (6) the NAPIO (1) the COAs (6) and the Vice Minister, acting as chairman. Recommendations for new varieties to be included on the MAF list for seed multiplication are made by a joint conference (meeting three times annually) composed of the technical staff of MAF, ORD, the three Crop Experiment Station directors, the PORD farm directors and COA professors. This conference evaluates the results of regional trials carried out on line selections at over 70 sites for paddy and 47 sites for barley and recommends the best varieties to the NSC which in turn advises the Ministry. Approval of a variety by the MAF indicates that seed of that variety will be multiplied by ORD to Foundation Seed and by PORD farms to Registered Seed.

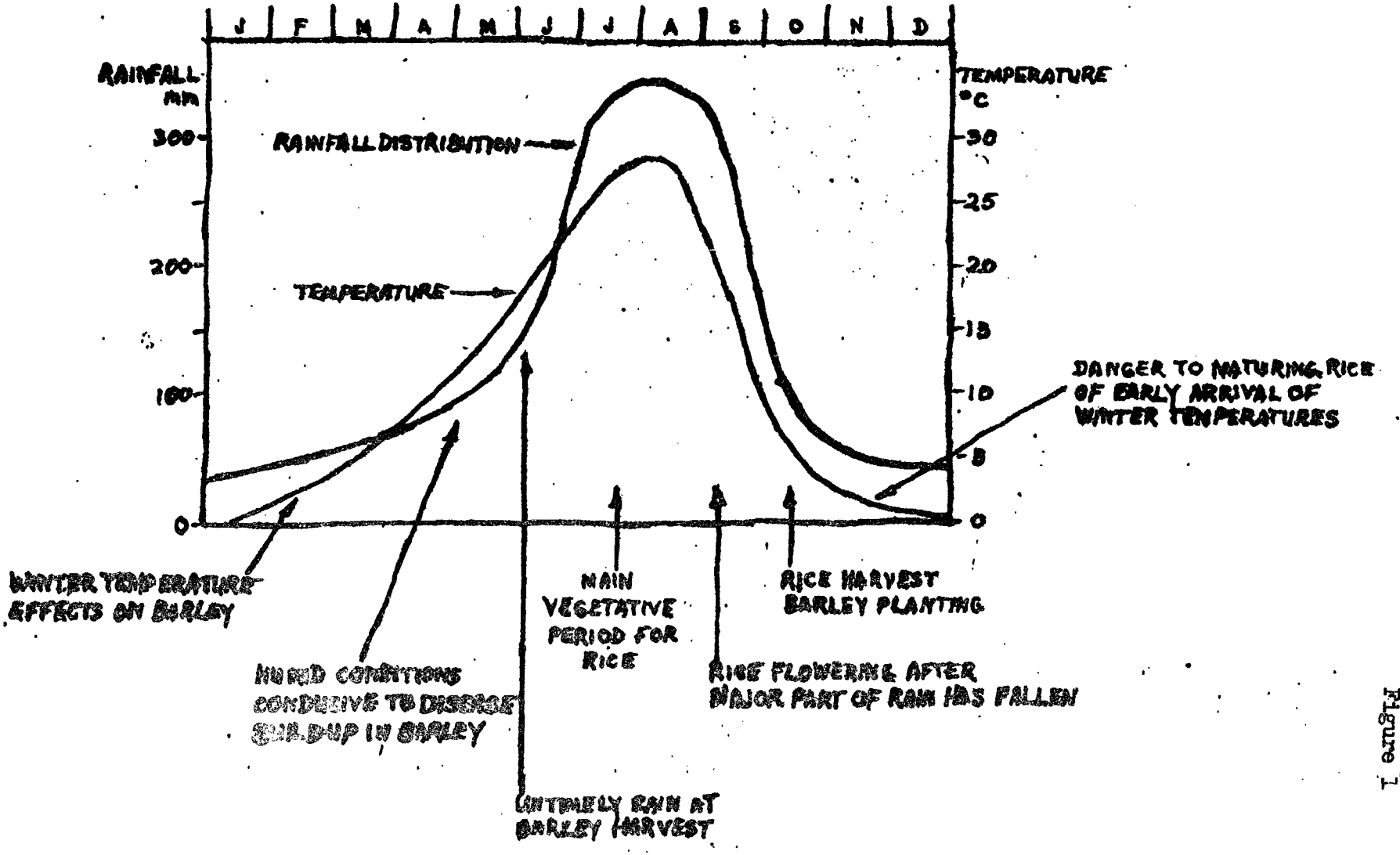
C. USAID Support in Crop Research

16. The ROK is negotiating a project for ORD, with USAID assistance, in the financing of crop research. The project, in its formative stage during appraisal, would strengthen the on-going ORD work by providing additional technical assistance, equipment and facilities for an intensive research program of crop breeding and cultural practices that would contribute to the solution of the major problems given in para 14 above. About 75 man-years of expatriate assistance of a team of plant breeders, pathologist, entomologist, agronomist, agricultural engineers and farm management economist would join the ORD scientists. The work would be concentrated on cereal grains, soybeans, potato and forages through FY 78 and with a possible renewal of aid as a part of a long-range development plan for Korean agriculture.

17. The type of research planned is an essential supporting element of the proposed seeds project. If the above arrangements fail to materialize, this project would need to be restructured to include crop research.

KOREA SEEDS PROJECT

DIAGRAM TO ILLUSTRATE THE CLIMATIC FACTORS AFFECTING RICE AND BARLEY CROPS IN THE REPUBLIC OF KOREA



ANNEX 3
Figure 1

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

PROJECT DESCRIPTION

A. General

1. The project would assist ROK finance the installation of five seed processing plants and storage facilities for field crops and six plants for seed potato and strengthen the agencies responsible for crop research (ORD) and seed quality control (NAPIO). The project would be supervised by the MAF. Investment funds provided for seed production, processing and storage would be provided by the Borrower to the Office for Seed Production and Distribution to be created in the MAF to operate these facilities. Farm machinery would be provided OSPD for operations on the seed production farms. The seed certification facilities of the National Agricultural Products Inspection Organization (NAPIO) would be strengthened to enable it to provide seed quality control services. Technical assistance in seed production; processing and quality control would be provided for in the Bank loan. A parallel financing arrangement between ROK and USAID would provide technical assistance and equipment for crop research. The project would be completed in five years.

B. Seed Production and Procurement

2. Seed Plant Locations and Production Targets: The possibility of expanding cultivable area in the ROK is extremely limited, any increase in production must come from multiple cropping and higher yields. Seeds of high yielding varieties, particularly with respect to paddy, barley, wheat, soybean and potato are a very important component in achieving increased output.

3. To determine the volume and kind of seed to produce and process, and the number, location, plant capacity and design, the mission made an extensive tour of the proposed sites identified by the FAO/IBRD/CP report and by ROK. The criteria used to help resolve these issues included (a) importance of the crop in the Korean economy, (b) the stage of crop research for the development of new varieties, (c) probable demand for Certified seed, (d) crop pattern and transportation resources by provinces, (e) seed quality control characteristics and (f) availability of crop land and progressive farmers for the production of Certified seed.

4. Based on these criteria, field crop seed processing and storage facilities would be located at Pyeongtaeg, Iri, Hampyeong, Euiseong and

Milyang. Six seed potato processing plants were chosen, one at the PORD seed potato farm at Daegwanryeong and five in nearby production areas; all above 800 m elevation as a means of controlling virus diseases. See IBRD Maps 10447 and 10516. At full development, 11,000 tons of paddy, 5,000 tons of barley, 1,000 tons of wheat, 500 tons of soybeans and 10850 tons of seed potato would be produced, processed and distributed each year as Certified seed. These quantities represent estimates of demand at full development and would provide the following percentages of national annual seed requirements: paddy, 23%; barley, 8%; wheat, 12%; soybean, 3%; and potato, 18%.

5. Field Crop Seeds: At each plant site, the OSPD would contract with a local Farmers Land Improvement Association (FLIA) for the production of field crop seeds (paddy, regular barley, wheat, naked barley and soybean). The FLIA is a cooperative organization originally designed to consolidate land holdings and develop the land for irrigation. After completing the on-farm land construction work, most FLIAs have continued their operations as joint-farming cooperatives. At each proposed site for a field crops seed processing plant, the mission met with officials and inspected the farm land of the FLIA proposed for the production of seeds for KNSC. In each case, some of the FLIA members had gained experience as seed producers under the existing program and were prepared to participate in the proposed project.

6. FLIA farms ranged from 600 ha to 6,000 ha in size. Within each farm seed production would be concentrated in land units of 20 to 30 ha "blocks" in which the same variety and uniform dates for all field operations would be maintained for each type of seed produced. Not more than three recommended varieties of any crop would be grown at each FLIA. Registered seed of the varieties selected would be produced by ORD on the PORD seed farms and provided to the OSPD for use with the FLIA seed growers. Quality control procedures as required to produce Certified seed would be performed under OSPD supervision and NAPIO inspection. OSPD would control harvesting, threshing and delivery to the seed plant for processing. FLIA seed producers would receive an incentive price, estimated at 10% to 20% above harvest market price, for all of their produce that met the Certified seed qualification standards.

7. The estimated land area required and quantity of field seeds to be produced at each location are as follows:

	Paddy		Soybeans		Barley		Wheat	
	ha. area	tons	ha. area	tons	ha. area	tons	ha. area	tons
Pyeongtaeg	715	2,850	310	230	425	850	175	350
Iri	635	2,550	65	50	525	1,050	75	150
Hampyeong	450	1,800	-	-	550	1,100	50	100
Euiseong	575	2,300	250	200	450	900	150	300
Milyang	375	1,500	-	-	550	1,100	50	100
Total	2,750	11,000	625	500	2,500	5,000	500	1,000

8. Seed Potato: The OSPD would manage the 450 ha PORD seed potato farm at Daegwanryeong where it would produce about 2,000 tons of Registered seed each year, with the technical assistance of the ORD Alpine Experiment Station staff. In addition, the OSPD would contract with FLIA cooperatives and indidividual farmers for the production of about 10,000 tons of seed potato that would qualify under NAPIO inspection as Certified seed. About 700 ha of land sown to Registered seed potato would be required each year. All of this area would be located above 800 m (see IBRD Map # 10376). Because of the scarcity of cultivable land in the mountainous region the seed potato processing and storage facilities would be located at five centers within 10 to 25 km from Daegwanryeong and with 100 to 200 ha of seed potato at each center.

9. Farm Machinery Operations: Tractors and tractor drawn plows, discs, rotavators, field cultivators, grain drills and combines would be provided to OSPD for use on hire basis at each seed processing plant. In most cases the field crops of paddy-barley and soybean-wheat would be produced in a double crop pattern on the same land. To maximize production of paddy and soybean seed per unit of land it would be necessary to harvest and thresh the barley or wheat within 15 days during early June. The land must be plowed and prepared for transplanting paddy before about June 25. Farmers with bullock powered equipment and manual labor cannot complete those operations within the time constraint. In addition, the migration of farm labor to industry has created a farm labor shortage unless mechanical equipment is added. Likewise, for seed potato equipment would be needed to enable planting early in May and harvesting before the danger of late October or early November freezing weather. Farm machinery and seed processing equipment would also be provided to ORD for use at the PORD field crop seed farms that produce Registered seed for OSPD.

C. Field Crop Seed Processing Plants

10. Development Strategy: Two of the expatriate consultants provided by the project would be posted to OSPD soon after approval by the Bank to assist OSPD prepare design specifications for tender documents and evaluate bids for the seed plant equipment and civil works. It is anticipated that the contract for these plants would be tendered by the end of the first year. The first of the five plants would be constructed and ready to receive paddy seed by October of the second year. Construction of the remaining four plants would be completed with equipment installed in time to receive barley and wheat seed for processing by June of the third year. These two consultants would also assist OSPD establish a system for operations and management and train seed plant operators. During the first two or three years of plant operations commercial quality seeds would be processed with the tonnage gradually shifted to Certified seed as OSPD, with the assistance of NAPIO, learned to improve its operations, and achieve the necessary quality standards. The projected annual volumes of seed production are given in Table 1.

11. Processing Plant Design Criteria: The proposed plant design and operational procedures allow for flexibility essential at peak intake times, particularly at the critical stage of drying. Equipment would be standardized and designed for easy cleandown between varieties and species and for maintenance. General specifications and functional uses are described below. Detailed specifications are given in Annex 9.

12. Operational Sequence and Timing: The approximate sequence and timing of plant operations would be as follows:

Sequence and Timing of Operations

Operations	Winter Crops Barley, Wheat		Summer Crops Paddy, Soybeans	
	Approx. Dates	Days Available	Approx. Dates	Days Available
Harvesting & Receiving	1-14 June	15 - 20	1-30 October	30
Precleaning	1-14 June	15 - 20	1-30 October	30
First Dry Down	1-14 June	15 - 20	1-30 October	30
Vent Bin/Storage) Final Dry Down) Vent. Bin/Storage) Fine Cleaning)	15 June to 15 Sept.	90	1 November to 31 March	150
Chemical Treatment) Packaging) Bag Storage)	15 August to 15 Sept.		1 - 31 March	31
Despatch	1 to 20 Sept.		15 March - 15 April	

13. Anticipated Field Crop Seed Flow Through Processing Plant: Likely average field crop seed losses are estimated as 4% in pre-cleaning and 16% during drying, storage, fine cleaning and packaging. Therefore, to allow for subsequent losses in drying and processing, the required field production and seasonal flow through each plant is obtained by adding 25% to the anticipated seed demand. The highest peak intake expected from the winter-crop season determines the drying and intake capacity of 50 tons per 10 hour day for each of two intakes that would be installed at each plant. The storage capacity is controlled by the summer crop seed targets after allowing for an extra 25% for small lots and bin interchanges. The details are given below and diagrammed in the attached Charts.

14. Threshing and Transport: Grain would be threshed by self-propelled combined or mechanical threshers. This equipment would be under the control of the OSPD management to ensure an even flow of threshed seed to the plant and to reduce the possibility of admixtures during threshing. Intake of seed at any one processing plant on a single day would usually be restricted to one variety, but three varieties could be handled in each season. Mechanically threshed seed would be placed into clean containers and it and the combined seed would be emptied into tipping trucks or tractor trailers and transported

to the plant immediately. When harvested the moisture content of paddy and soybean would usually range between 18 and 20%; barley and wheat between 20 and 22% and may be as high as 24% during rainy weather.

15. Intake and Precleaning: Incoming seed would cross a weight bridge that provides a print out showing gross and tare weights of the seed received. The lot would then be sampled to provide purity, moisture, germination and clean seed out-turn information. The estimated clean seed out-turn and dry weight would be the basis for payment to each contract grower providing other quality conditions had been fulfilled. Samples would also be drawn at this point by the NAPIO seed inspection officer to determine the certification status of the particular seed lot.

16. After acceptance, seed would be tipped into an intake pit of 5 ton capacity and would discharge into surge bins of 10 tons capacity via bucket elevators of 20 tons per hour capacity. The bins would gravity serve a de-awner, which is included especially for barley and wheat though the same equipment would help break up trash and polish all seeds. The seed would move down to a pre-cleaner of 20 ton per hour capacity equipped with an aspiration leg to separate chaff and light screenings. Use of the pre-cleaner before drying is essential for the protection of subsequent equipment and for the prevention of blockage of material flow.

17. Drying and Storage: Following pre-cleaning, seed passes directly to the dryer surge bin and is dried. Two continuous flow dryers each of 10 ton/hour capacity and operated during peaks on a two shift basis of 10 hour per shift have been specified for drying to safe holding moisture levels. A continuous flow dryer system provides a forced flow of heated or ambient temperature air while the seed is turned and mixed. Regular sampling would be routine to measure drying effectiveness. Field seed at 18 to 24% moisture would be dried to a safe holding moisture of about 16% and held for redrying after the close of the intake season. Usually, at least two passes through the dryer are required to dry seed from 20 to 24% moisture down to a safe storage level of 12 to 14%. Between passes the seed is "tempered" in holding bins from 12 hours to 30 days, depending on moisture content and local weather conditions. Following a final pass through the drier the seed, at 12 to 14% moisture, would be returned to the storage bins to await fine cleaning. Heated air temperatures for drying would be no more than 40°C. Each dryer would have an ambient air fan to ensure that the seed is cooled after drying.

18. Storage bins would be of steel construction, 80 ton capacity each, and connected to a forced ventilation system to permit easy control of seed temperature during storage. Temperature monitoring devices would be installed in each bin. A special bottom would permit rapid and complete emptying. Bins would be fed and emptied by horizontal belt conveyors and would be so designed to allow rapid exchange of seed between bins or the direct movement from bins to any section of the processing plant, e.g. to the driers, fine cleaning section, seed treatment and the packaging section. Storage bins of 20 ton capacity are provided as "working bins" and for small lots of seed. Space for about 700 tons of flat storage would be provided at each plant.

19. Seed Processing Equipment: Seed cleaning equipment capacities have been determined on the basis of time available for this operation for each crop and to allow adequate time for thorough cleaning of bins and equipment between varieties and species. Seed cleaning would not be carried out when the drying plant is in full operation as the plant employees would be required to receive the seed from farmers and operate the driers at that time. All calculations are based on 24 operating days per month and 10 effective operating hours per working day. The recommended capacity is rounded to the nearest 4 ton capacity unit allowing for the maximum standardization of plant components. Grading equipment would allow for both weight separation and size grading. Fine cleaners would be equipped with at least four offset screens, fully adjustable pitch, variable shaker speed and two air separations with variable fan control. Length grading by indented cylinders or discs would be necessary for the removal of small and broken grains, weed seeds and seeds of other species.

20. Seed Treatment and Packaging: A semi automatic high speed wet seed treater and automatic weigher-bagger machine with a capacity of 5 tons per hour packaged in polyethylene heat-sealed bags would be provided. Cereal seed would be treated against seed-borne diseases with liquid organo-mercurial dressing or suitable substitutes. Treatment to control loose smut should be used as necessary. Fungicides and a differential stain would be used to show clearly that the seed has been treated with poison. Labels would be attached as required by NAPIO regulations. Size of bags would relate to size of fields and demand for seed from small and larger farmers would entail packaging in a range of sizes between 5 kg and 30 kg. After packaging small bags would be group packed into appropriate shipping sizes.

21. Other Facilities: Each plant would be equipped with (a) a workshop and tools to carry out regular maintenance and minor repair works; (b) offices for five to seven persons; and (c) a small seed testing laboratory equipped to test up to 2,000 samples per year for moisture, species purity and germination. Laboratory equipment would include seed triers, moisture proof sample bags, sets of grain sieves, sample dividers, analytical balances, pocket magnifiers, vitascopes complete with splitters, seed kits and powder, cabinet germinators, refrigerators and aluminum seed trays; (d) two 5-ton tipping bulk grain trucks, five tractor trailers, one jeep and two motorcycles; (e) service buildings to house farm machinery, conference room, dormitories and lounge facilities. About one ha of land would be required for each plant.

D. Seed Potato Processing and Storage

22. Grading equipment and storage for 2,000 tons of Registered seed potato would be provided at the PORD farm and for 10,000 tons of Certified seed potato at five near-by locations. Construction at the PORD farm and at one potato storage plant would be completed in time for the October, 1975 harvest, and the remaining four plants by October, 1976.

23. In planning for seed potato production about 15% was added to the planned Certified sales target to allow for field grading and storage

losses. Potatoes would be harvested in late September and October and rough hand graded over a screen into straw bags and transported to the storage facility. Incoming potatoes would be weighed and sampled to provide a grading out-turn which would be used as a basis for payment to contract growers. Samples would also be drawn to ascertain disease levels and to determine certification status of the particular seed lot. After acceptance, potatoes would be placed in storage in bulk heaps with straw bag walls to separate seed lots. Storage for about 2,000 tons is provided at each center. The storage building would be double walled with enclosed air space for insulation and covered with soil. Potatoes would be stored until late January and February.

24. Potatoes - Grading Equipment and Operations: Fine grading equipment capacities were based on 36 work days of 8 hours each in January and February. Potatoes would be taken out of bulk store either by hand or a tractor mounted with a front-end bucket, dry brushed, elevated to an electrically driven roller grader and hand picking table and finally treated and placed into 40 kg straw bags and labelled according to the NAPIO regulations. Potatoes not acceptable for seed would be sacked separately and sold on the commercial market. Specifications for the seed potato grading equipment are given in Annex 9.

E. Seed Distribution and Marketing

25. As detailed in Annex 2, the ROK has had vast experience in the use of its Rural Guidance Officers and other agricultural staff for the assessment of demand and distribution of agricultural production inputs including seeds. In this project, the OSPD would determine demand with the assistance of the MAF and representatives from each provincial government for seeds of each variety recommended by NSC 12 to 14 months in advance of planting date - March 1 for paddy, May 1 for soybean, September 10 for barley and wheat, and February 1 for seed potato. This assessment of demand may be only a target number or it may be supported by firm orders with downpayment from farmers. The "lead time" is necessary to assure the production of Registered seed by the PORD for delivery to the OSPD. The demand assessment would be allocated to each processing plant and would be the basis of OSPD contract arrangements for seed production with the respective FLIAs.

26. The NACF with its 6,000 retail farm input supply stores would serve as the major wholesaler-retailer. Before fine cleaning, treating and packaging, the OSPD would confer with each provincial government regarding volumes of seed to be shipped from each plant to the respective wholesale and/or retail stores. NACF would accept delivery of the seed on consignment and arrange for its transportation and marketing to farmer users. Some of the seed would be delivered by NACF to other licensed private seed dealers and to Rural Guidance Officers for ultimate sale to users. NACF and other seed dealers would settle their accounts with OSPD as the seed is sold.

27. Projected sales by plant location to each province are given in Table 2.

28. Seeds would be priced at a level that would recover all costs of OSPD, including operations, maintenance, loan service charges and a reserve for risk and uncertainty. To recover all costs at full development and 1972 basic prices it is estimated that prices per ton for Certified seeds would be about as follows: paddy, US$340; regular barley, US$195; naked barley, US$219; wheat, US$201; soybeans, US$370 and potato, US$192. These prices represent a relative mark-up from commercial market prices at planting season of about 46% for paddy, 70% for barley and wheat, 52% for soybeans and 109% for potato. In the existing seeds program, the planting season mark-up has varied from 0 to 40%. During the first five years of the project the mark up would be increased to the level where all costs would be recovered. The existing seeds program costs ROK about US$1.0 million per year for payment of incentives to seed growers. As the program gradually shifts operations to the OSPD and full recovery of costs, this expenditure would be saved.

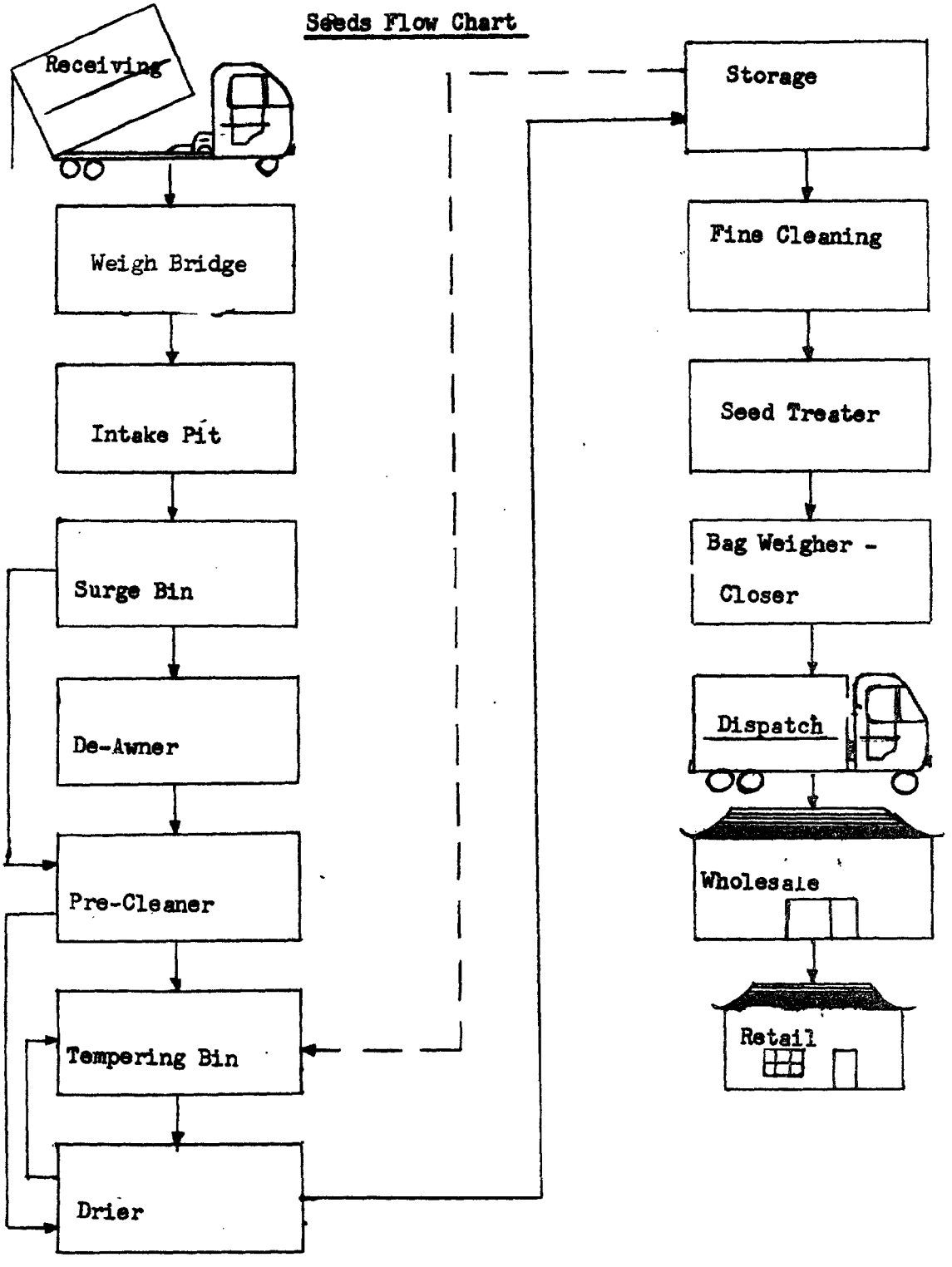
September 20, 1973

Annex 4
Chart I

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

Seeds Flow Chart

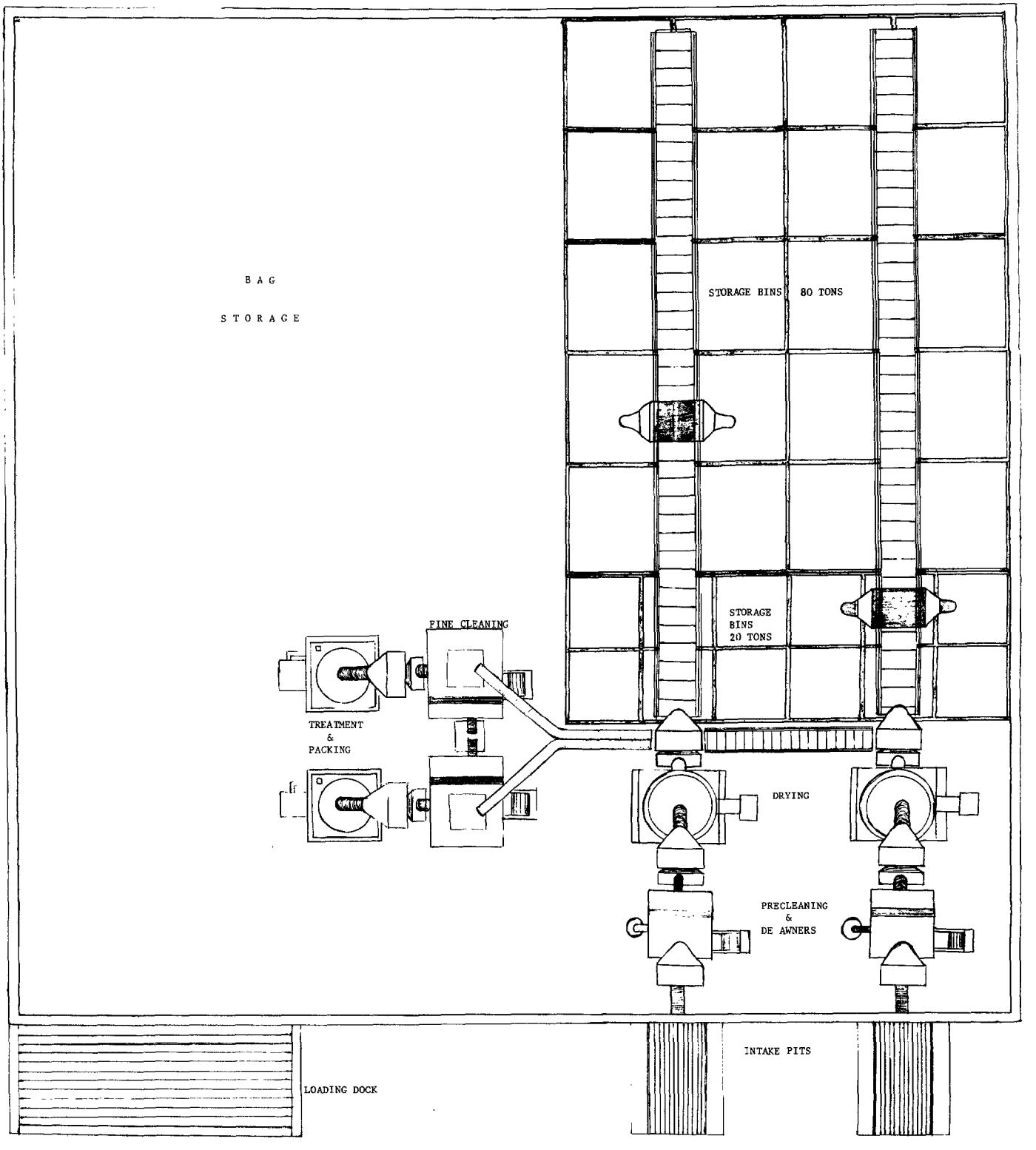


REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

FLOOR PLAN FOR PROCESSING PLANTS

ANNEX 4
chart 2

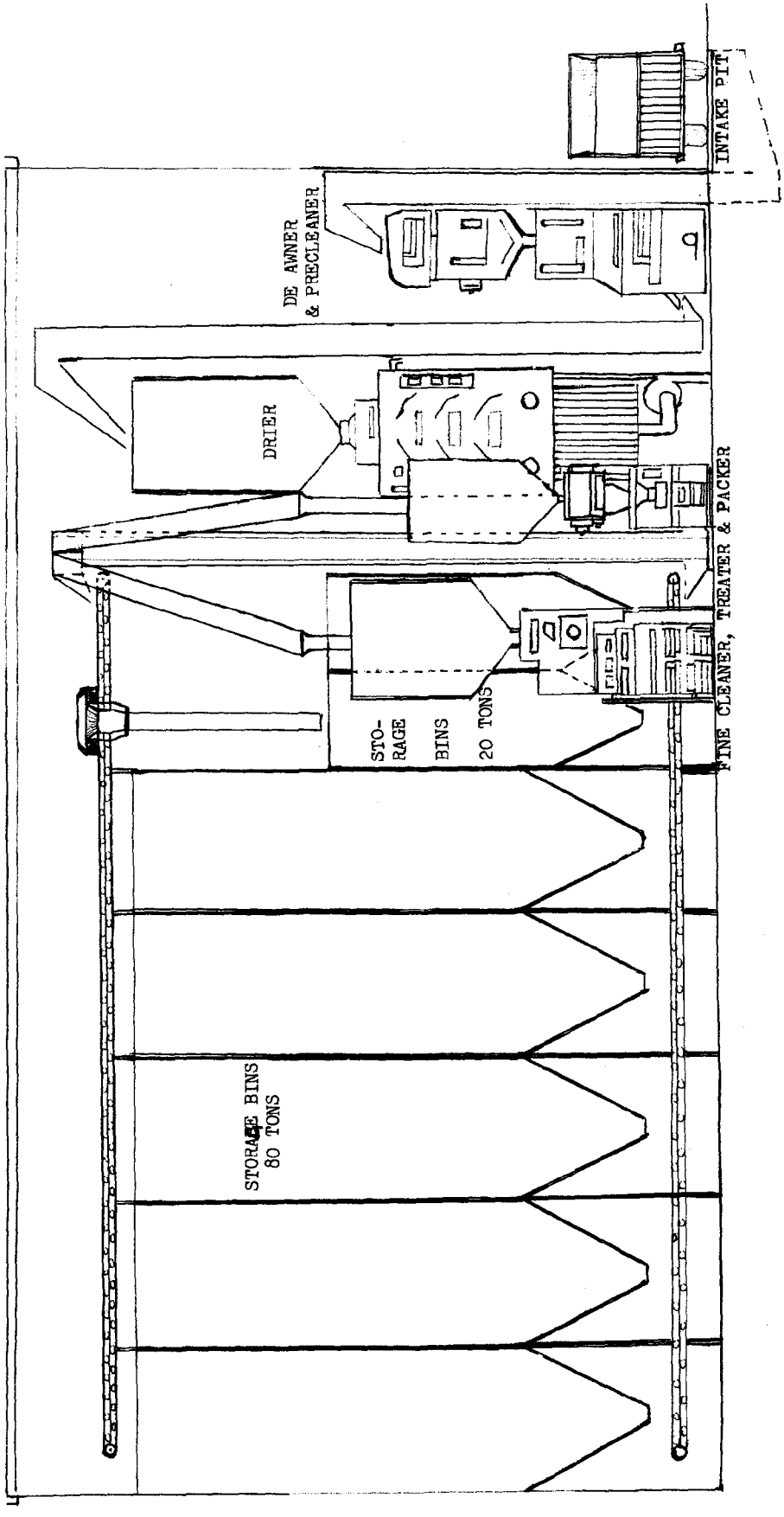


REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

SIDEVIEW OF PROCESSING PLANTS

ANNEX 4
chart 3



Annex 4
Table 1

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

Projected Seeds Production

Location	Grade	1974		1975		1976		1977		1978 (& later years)	
		Wheat Barley	Rice	Wheat Barley	Rice	Wheat Barley	Rice	Wheat Barley	Rice	Wheat Barley	Rice
		- - - - - - - - - - - - - - - - - - t o n s - - - - - - - - - - - - - - - - - -									
Pyontaek	Certified	-	-	-	500	500	1500	800	2000	1200	3100
	Commercial	-	-	-	1000	1000	1700	400	500	-	-
Iri	Certified					500	1500	800	2000	1200	2600
	Commercial					500	1400	400	500	-	-
Hampyong	Certified					500	1500	800	2000	1200	1800
	Commercial					500	1400	400	500	-	-
Eaisong	Certified					-	-	800	1500	1200	2500
	Commercial					-	-	400	500	-	-
Milyang	Certified					-	-	800	1500	1200	1500
	Commercial					-	-	400	500	-	2500
TOTAL	Certified				500	1500	4500	4000	9000	6000	11500
	Commercial				1000	2000	4500	2000	2500	-	-

KOREA

KOREAN SEEDS PROJECT
DISTRIBUTION OF SEED FROM PLANTS TO PROVINCES (In Tons)

	GANG WEON	GYEONG GI	GHUNG CHEONG BUG	CHUNG CHEONG NAM	JEOLLA BUG	JEOLLA NAM	GYEONG SANG BUG	GYEONG SANG NAM	TOTAL
Pyongtaek:Plant									
Paddy		1600	700	550					2850
Regular Barley	100	250	300	200					850
Wheat	50	100	100	100					350
Soybean		100	50	100					250
IRI :Plant									
Paddy				1000	1550				2550
Regular Barley				50	50				100
Naked Barley				250	700				950
Wheat				50	100				150
Soybean					50				50
Hampyong:Plant									
Paddy						1800			1800
Naked Barley						1100			1100
Wheat						100			100
Uiseong:Plant									
Paddy	500						1800		2300
Regular Barley							900		900
Wheat						100	200		300
Soybean	50						150		200
Milyang:Plant									
Paddy								1500	1500
Regular Barley								650	650
Naked Barley						100		350	450
Wheat								100	100
Daegwanryong Plant	4500	1500	1500				3350		10850

ANNEX 4
Table 2

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

THE NATIONAL AGRICULTURAL PRODUCTS INSPECTION OFFICE (NAPIO)

General

1. The success of the project would depend on the quality of seed produced. The farmer must be assured that the seed he receives has some form of guarantee and possesses desirable characteristics for germination, varietal authenticity, high yield, resistance to disease and pests, lodging, short maturity period, and non-lodging, acceptable cooking quality. The proposed Seed Certification Service (S.C.S.) backed by Seeds Legislation would be designed to win the confidence of farmers in new seeds and new varieties so as to expand sales and concurrently raise agricultural production.

2. The initial factor determining the standard for Certified seed is the variety purity of the material obtained from the plant breeder. The seed is multiplied through at least four generations, under both field and laboratory control, before being sold to end-user farmers for commercial crop production. These generations are described as:

- Breeders Seed: It would be produced by ORD, COA or other breeders according to the generally accepted practices for the maintenance of the variety intended for the production of Certified seed. The breeder is responsible for maintaining a supply of parental material that preserves the character of the variety and deciding the number of generations from the parental material that Breeder seed should be multiplied before releasing to avoid deterioration of varietal purity.

- Foundation Seed: Is the first generation multiplied from Breeder's seed, and would be produced by ORD under the supervision of the breeder.

- Registered Seed: Is the first generation multiplied from Foundation seed. It would be produced on PORD farms under certification rules.

- Certified Seed: Is the first generation multiplied from Registered seed. It would be produced by FLIA farmers under contractual arrangements with OSPD and NAPIO certification rules.

3. The basis for the seeds industry in Korea is a Seeds Law of Staple Crops - Statute No. 975 of January 16, 1972, with its amendments and regulations. The term "seed" would cover vegetative parts and organs used or

intended for multiplication. Existing statutes and decrees are inadequate for the purposes of the project and would be revised, consolidated and amended to provide for the following:

(a) to assure farmers that seed offered for sale meets minimum quality standards as labelled;

(b) to prevent misrepresentation and fraud in the sale of seed;

(c) to authorize the Minister of Agriculture to sample, inspect, analyse and test all "seeds" as defined, sold or offered for sale within ROK;

(d) to authorize the Minister of Agriculture to introduce a Seed Certification Scheme;

(e) to designate the organization to be responsible for the administration of the Seed Certification Scheme;

(f) to provide for the establishment of a Seeds Law enforcement section with laboratory facilities;

(g) to authorize the seizure and destruction of seed where the owner or custodian has failed to comply with the provisions of the Seeds Act;

(h) to provide a method of appeal against orders issued by the Minister of Agriculture;

(i) to provide for disclaimer or non-warranty clauses on invoices, advertising or labeling of any seed covered by the Law;

(j) to provide penalties for the violation of the provision of the Law and for the rules and regulations set up under the Seeds Law.

4. The MAF would authorize the creation of an administrative body, the Seed Certification Service (SCS) as a division of NAPIO to be responsible for all aspects of seed control such as variety listing, seed certification, control of seed importation and seed exports, Seed Law enforcement, laboratory and field testing.

5. Technical details of the Seed Law would be covered by regulations which would be drafted in such a way that ROK could participate in the different seed schemes of the Organization for Economic Cooperation and Development, apply for membership in the International Seed Testing Association and adopt the principles of the International Convention for the Protection of New Plant Varieties. The regulations would cover technical details regarding: (a) the creation of the SCS; (b) the establishment of a list of

Recommended Varieties; (c) Seed Certification; and (d) Seed Import and Export. The rules concerning arbitration, violations and punishments would be prepared by legal advisors in line with other laws dealing with economic matters.

Seed Certification Service

6. The SCS would comprise three sections:

(a) Head Office: This would be at the NAPIO's headquarters in Seoul. It would generally direct the service, and maintain liaison with other divisions within NAPIO and with other agencies concerned in the project, notably NSC, OSPD, ORD and the APB of the MAF. The Director and Section Chief would be located at the main office in Seoul.

(b) Field Supervision Section: This section would be set up at Suweon and would supervise (i) field inspection, control of seed harvesting, transportation, processing and storage; (ii) seed sampling, sealing and labelling; (iii) conduct "pre" and "post" control on-growing trials on land to be provided at Suweon - i.e., to test breeder, foundation, registered, certified, and other seed samples by growing small sub-samples alongside known standard samples to check genetic purity and other factors such as varietal admixture, presence of seed-borne diseases which may not be discernible in the laboratory; (iv) test all seed samples drawn by NAPIO field inspectors at the instance of SCS's Administrative and Seed Trade Regulation Section; (v) maintain a register of seed growers and stocks; and (vi) train Crop Inspectors and Guidance Officers.

7. The NAPIO/SCS would delegate powers to its inspectors, samplers and analysts for access and inspection at any reasonable time (a) to fields of crops producing seed under the Scheme; (b) to premises, plant and records where seeds under the Scheme are processed and stored; (c) to premises of retailers who are selling seed produced under the Scheme; (d) to draw samples from fields, at threshing, during processing and at points of storage; (e) to conduct tests on seeds as prescribed; (f) to issue laboratory certificates for seeds that fulfill the required conditions; and (g) to conduct pre and post-control tests.

8. Regional Offices: A regional office of the SCS would be established at the NAPIO office in each province where field crop and potato processing plants are situated. The chief would be an officer of the Field Supervision Section. He would supervise two analysts for potato quality control and the existing specially trained field crop and potato crop inspectors. Appropriate offices, laboratories and transport facilities would be provided. Inspectors would be required about three months per year for inspections and sampling work for this project.

9. National Seeds Laboratory: This would be a fully staffed and equipped seeds laboratory located at Suweon to handle 5,000 samples per annum. It would provide a national seed testing service to KNSC and to

farmers, farmer organizations, seed companies, seed traders, government agencies, etc. Examinations would cover purity analysis, determination of weeds and other seeds, germination, seed health, moisture content and varietal identity. It would issue seed analysis certificates. It would random check results of NAPIO/SCS branch seed laboratories for seed samples drawn by Field Supervision Section officers in seed growing areas. Seed analysts would be trained at the laboratory.

10. A Section Chief and six analysts would be needed at full development. The Section Chief would be required to attend a suitable training course similar to that provided at the National Institute of Agricultural Botany, Cambridge, U.K. or at the Seed Technology Laboratory, Starkville, Mississippi and to receive four weeks familiarization before the course and four weeks instruction in administration of a Seed Testing Laboratory. Seed analysts, crop inspectors, guidance officers and seed group chiefs would be trained locally and at the ORD and COA/SNU training centers Suweon.

11. One inspector would be needed for each 80 ha of cropland producing Certified seed. Each field would be inspected before the crop is planted and at least once during the growing season. An inspector would be present during the threshing of contract crops. Estimated areas for the project to be inspected for Certified seed by years are as follows:

	1974	1975	1976	1977	Full Development
	ha				
Potatoes	50	310	580	700	850
Field Crop					
Summer Crops (Paddy and Soybean)	-	150	1,300	2,600	3,325
Winter Crops (Wheat and Barley)	-	-	700	2,000	3,000

12. The Director of the SCS would have appropriate technical training and administrative experience. An experienced expatriate seed certification expert would advise for three years. Additionally, an experienced seed analyst would be provided for a total of one year to review training and laboratory techniques and procedures of the National Seeds Laboratory and Branch Seeds analysts. The Director of the Service and Section Chiefs would be granted scholarships to attend appropriate seed testing courses.

13. Investment Costs: The estimated cost for facilities and items of equipment are summarized in Annex 7. Procurement specifications are given in Annex 9. Recurrent costs are summarized in Annex 11.

14. Recovery of Costs: The SCS would recover additional costs of operation from suitable charges levied against those who use its services. A certification fee for inspection of US$5.00 per ha and a charge of 50 cents (US) per ton for sampling and 50 cents (US) per ton for fixing certification labels and tags would recover all added project costs. A general charge of US$1.25 would be made for each sample submitted for analysis by other than project seed growers.

September 20, 1973

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

ORGANIZATION AND MANAGEMENT

A. General

1. The MAF would be responsible for over-all project coordination of the appropriate departments, agencies and provincial governments and with the ADC it would manage the feasibility studies. An agency, the Office for Seed Production and Distribution (OSPD) would be established in the MAF to be responsible for project investments concerned with the production, procurement, processing, storage, packaging and distribution of seeds. Project investments for strengthening the seed certification services would be managed by NAPIO. Crop research and the production of Breeder, Foundation and Registered seed would be managed by ORD with the assistance of USAID parallel financing. The NSC would assist the MAF by recommending seed varieties for multiplication each crop season and by providing suggested general standards for seed certification and regulation of the industry. All of these departments and agencies, except OSPD, are experienced in working together under the leadership of the MAF for the operation of the existing crop research and seed program (Annex 2). Functional responsibilities for each department and agency are summarized below.

B. The Office for Seed Production and Distribution (OSPD)

2. The OSPD would be established by the ROK by amending the Seed Law of Staple Crops (Law no. 975) of January 16, 1972 as amended (Annex 6). It would operate as a separate agency in the MAF under regulations issued pursuant to the Seed Law and under the direction of a Chief Executive Officer who would be responsible directly to the Assistant Minister. Administrative divisions of the OSPD would be responsible for project administration and operations, financing and budget control, seed production and procurement, farm machinery operations and seed processing and distribution. A manager trained in seeds production processing, storage and marketing, would be in charge of operations at each seed plant. Terms of reference are given in Appendix C.

3. The Chief Executive Officer would prepare a budget that estimates the capital and operating expenditures, including contingencies prior to the beginning of each fiscal year. He would be entitled to transfer, with prior advice to the Minister of EPB, between categories and sub-categories or groups the funds allocated by the budget. The investment line headings

would be more or less as given in Annex 7, Table 1. Operation line headings would include a Revolving Fund (para 4.04) and a separate account for the hire-operation of the farm machinery provided by the project. The OSPD would receive financing from ROK for its investment and operating budget on an annual basis and for its Revolving Fund on a permanent basis. The Revolving Fund would be used for the procurement of seeds from contract growers and would be credited with the entire proceeds of its seeds sales less distribution expenses. Surpluses, if any, could be used for annual operating expenses. ROK would finance the Revolving Fund at the commencement of the fiscal year with not less than the Won equivalent of US$300,000 in 1975, US$1.1 million in 1976, US$4.1 million in 1977 and US$5.4 million in 1978.

4. The OSPD would be responsible for implementation of all aspects of the project concerning the production, processing, packaging and distribution of Certified seeds. In this respect the Chief Executive Officer and his administration and operations divisions, with the assistance from domestic and expatriate consultants would design each seed plant, specify equipment, prepare tender documents, evaluate bids and supervise construction of civil works and the installation of equipment. After construction has been completed, the staff would be trained by the suppliers and the consultants in the operation of the seed plants. The budget control division would maintain project investment and operations accounts on a commercial accounting basis.

5. An analysis of the projected monthly cash flow of OSPD shows that these inventories reach a peak in November each year and remain at high levels until the following June. If the funding of seed inventories were achieved by commercial bank financing the interest charge would be about 1.5% per month and the availability each month in the amounts needed would not be assured. In addition, seed prices would need to be increased by US$25.00 to US$30.00 per ton to recover the high interest charge. At these higher prices the volume of sales would be reduced and the financial rate of return for the OSPD and the national economic rate of return would be greatly reduced. If financed from annual budget appropriations, the OSPD would have the high risk of disapproval or delay in obtaining the needed funds. The risk of inadequate financing would be minimized if a Revolving Fund were provided for this purpose.

6. During the 30 year estimated life of the project the OSPD would recover its costs; i.e. administration and overhead, procurement, processing, storage, distribution, plant repair and maintenance and loan service charges; from the sale of seeds. Its costs for Registered seed and for farm machinery operations would be recovered from seed growers. Fees paid NAPIO would recover its investment and operating costs for the certification of project seeds. Estimated operating costs are detailed in Annex 11.

7. To recover the above project costs at 1972 prices, it would be necessary to price the field crop Certified seeds to farmers at an average margin of 65% above and seed potato at 160% above the crop harvest prices. In the existing program field crop seeds have been priced at 20% above harvest prices for average quality seeds and as high as 100% above for

Registered seed and seed of new varieties. Seed potato are usually sold with a margin 100% or more above the harvest price. At these prices, ROK absorbs a loss of about US$1.0 million per year or US$20.00 per ton of seed for the payment of the premium to seed growers and US$5.00 per ton for seed promotion activities. With the project all of the grower premium costs and a part of the seed promotion costs would be transferred to the OSPD.

8. Korean farmers may not be willing to purchase the available supply of project seeds at 65% or 160% above harvest prices for the first three or four years. Pricing seeds at, say, a 40% mark-up for field crops and 120% for seed potato the first year of operations (1975 for potato and 1976 for field crops) and gradually increasing the mark-up to cover all costs by 1979 would be acceptable. Losses accruing during this time would be covered by the annual operating budget and the Revolving Fund. It would also be necessary for the ROK and the respective provinces to transfer their existing support of the seed industry for field crops and seed potato to the OSPD.

9. However, during the 30 year life of the project costs and the percent mark-up for each crop would be sensitive to harvest prices, premium arrangements contracted with the FLIA Certified seed growers, deviations from the projected volumes and operational costs. The necessary selling price as calculated above may not be the appropriate price to be charged farmer-users of the OSPD Certified seeds. Selling prices would be determined for each crop each year and should be adjusted to reflect changes in costs, the value of crop yield responses obtained from the use of Certified seeds, the introduction of new varieties, competitive prices and reliability of seeds available from other sources and other market factors.

10. While the MAF has had extensive experience in the production and distribution of seeds with its existing subsidized program, it has had only limited experience in the marketing of Certified seeds. Market experience in the sale of its surplus Registered seeds and the introduction of Tongil, a new higher yielding paddy variety, indicate that farmer-users were willing and did pay up to double the market grain price for these items. However, the OSPD would need to continuously evaluate demand for its various crop varieties and to analyze costs so that all Certified seed produced would be sold and at prices sufficient to recover all costs. Therefore, the OSPD would establish an operational research section to help it evaluate costs and demand factors needed to set seed selling prices so as to recover full production costs. Full production costs would be defined to include (a) seed procurement; (b) operations of and maintenance and depreciation on buildings, plant, machinery, equipment and materials used in growing, processing, marketing and distributing seeds; (c) overhead, representing administration and other indirect expenses incurred; (d) interest paid on borrowings; (e) taxes paid; and (f) a return on net capital employed on a long term basis.

C. NAPIO

11. The OSPD would arrange with NAPIO to perform independent inspections and laboratory tests as needed to determine eligibility of all seeds sold as Registered or Certified. Seeds meeting these standards would be labelled and distributed as such. Seeds that failed to meet the certification standards, would be marketed as commercial seeds, if viable, or as grain or potato. NAPIO would charge inspection fees at rates sufficient to cover the added costs of its services (see Annex 5, para 14). NAPIO would regulate the entire seeds industry in Korea.

D. The National Seeds Council (NSC)

12. The NSC would be reorganized under the chairmanship of the MAF Vice Minister and would advise the MAF on the planning, formulation of policy, regulation of the Seeds Law, approval of the recommended varieties for each crop and any other matters as necessary for an orderly development of a sound seeds industry. The Vice Minister as chairman would act for the Minister of Agriculture who would appoint other members of the Council to include representatives of OSPD, ORD, NAPIO, APB, provincial governments, COAs and the private seed industry. The director of the APB would serve as secretary for the NSC. The NSC would be advised on technical matters by appropriate committees with members who are experts in a particular field. Such committees would include (a) variety review and recommendations; (b) seed imports and exports, and (c) seed standards, and regulation of the seeds industry.

13. Varieties would be included in the Recommended List only if satisfactory trial results show them to be above average in agro-economic aspects and that they had distinct, uniform and stable characteristics. Applications from plant breeders for varieties to be included on the Recommended List would be accompanied by a full description including morphological, physiological and agronomic-economic characteristics. Samples of Breeder seed would be reproduced and tested from time to time to ensure that varietal purity had been properly maintained.

E. Project Technical Assistance

14. The ROK lacks technical experience in the design, construction, operation and management of a seeds processing industry. Also the NAPIO lacks experience in the field inspection and laboratory operations of a Certified seeds program that uses internationally accepted procedures. There also would be a need for legal expertise for revisions of the Seeds Law and preparation of OSPD's terms of reference and tender documents. Therefore, to achieve project objectives, expatriate consultants would be engaged to assist as follows:

OSPD	Man-months	Project Years 1	2	3	4
Seed Project Management	39	9	12	12	6
Seed Processor and Plant Operations	33	9	12	12	
Agr. Engineer - Farm Machinery	24	3	3	12	6
Agronomist - Certified Seed Production	30		6	12	12
NAPIO					
Legal Adviser (OSPD and NAPIO)	3	3			
Seed Certification Training	36	6	12	12	6
Seed Testing (Laboratory)	6		3		3
Total	171	30	48	60	33

15. The USAID parallel financing of crop research would provide about 75 man-years of technical assistance during the first five years of the project. Expatriates with expertise in crop breeding, plant pathology, plant chemistry, agronomy, cropping systems, agricultural engineering and agricultural economics would be included. Their terms of reference and arrangements have not been detailed in this report.

F. Training of Staff

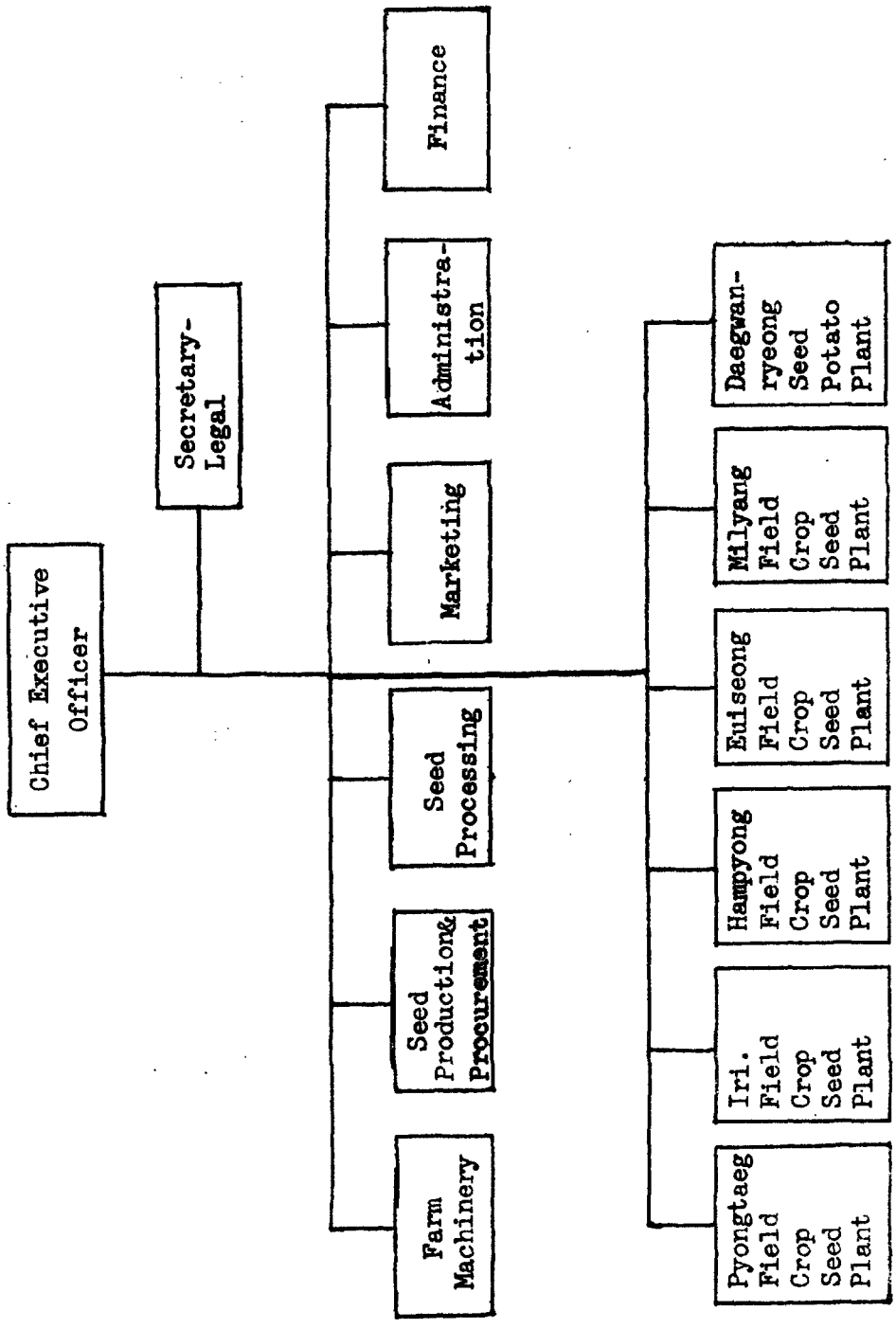
16. Because of lack of experience with a seed program of the type proposed for the project, the OSPD technical staff would need to be trained. The project provides for international travel and study for the Chief Executive Officer and selected key staff members. Equally important, the plant managers, guidance officers and technicians of all types, about 100 people, who would be trained on the job. The consultants and the appropriate OSPD, NAPIO and ORD officers would be responsible for organizing and providing this training.

REPUBLIC OF KOREA

ANNEX 6
Chart 1

KOREAN SEEDS PROJECT

OSPD ORGANIZATION CHART



REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

DRAFT TERMS OF REFERENCE FOR CONSULTANTS

1. Office for Seed Production and Distribution: The following consultants would be provided OSPD by a consulting firm:

(a) Project Management Consultant: To serve as the OSPD consultant team leader and to advise the MAF, and the Chief Executive Office on the following:

(i) General policies regarding the organization, staffing and management of OSPD;

(ii) preparation and evaluation of tender documents and contract supervision for civil works and equipment on the basis of the Bank's "Guidelines for Procurement under World Bank Loans and IDA Credits" - April 1972, revised in October 1972;

(iii) operation of the National Seeds Council;

(iv) preparation of administrative manuals with detail on procedures for personnel selection and training, accounting, and operations;

(v) organization of training activities including the training of seed plant managers in administration; and,

(vi) establishment and operation of seed processing plants.

Qualifications: Ten to 15 years successful experience in the seeds industry and demonstrated ability as an administrator.

(b) Seed Processor and Plant Operations Consultant: This expert would advise and assist the OSPD in the:

(i) preparation of detailed specifications for all tender documents for all seed processing plants, buildings and equipment, evaluation of bids and supervision of construction;

(ii) training of the technical staff in the operation of all seed plants; and,

(iii) preparation of seed plant operations manuals.

Qualifications: At least ten years experience in seed processing, particularly in cereals, and with a degree in Agricultural Science or Agricultural Engineering.

(c) Agricultural Engineer - Farm Machinery Consultant: He would assist the OSPD:

(i) prepare specifications for the tender documents and evaluate bids for all farm machinery and workshop equipment required for the project;

(ii) organize and participate in the training of OSPD farm machinery engineer mechanics and tractor operators;

(iii) establish a system for the operation and maintenance of the workshop and inventory of spare parts and tools;

(iv) supervise field work for the farm machinery; and,

(v) prepare farm machinery operations manuals.

Qualifications: At least ten years experience in the supervision of farm machinery repair, maintenance and operation and a graduate in Agricultural Engineering.

(d) Agronomist - Certified Seed Production: He would assist OSPD -- and liaise with ORB and NAPIO as appropriate, in:

(i) the planning and operation of the production of Registered seeds at the PORD seed farms and Certified seeds on the FLIA farms;

(ii) providing technical information on all aspects of agronomy, water management, pest and disease control, application of fertilizers, crop rogueing, harvesting and threshing;

(iii) the training of the OSPD Rural Guidance Officers; and

(iv) the preparation of seed production manuals.

Qualifications: Five to ten years experience in Certified seed crop production, preferably of cereal seeds, and a college graduate in the Agricultural Sciences with a major in agronomy.

2. NAPIO: The following consultants, not necessarily from a consulting firm would be provided for NAPIO:

(a) Seed Legislation Consultant: This consultant would assist MAF and NAPIO draft revisions and amendments to the Seeds Law - providing the detail needed to (i) establish OSPD; (ii) determine minimum standards for seed certification, provisions for

seed testing, declaration of results to farmers, registration of new varieties, licensing of seed dealers, labeling of seed containers, etc. as needed for NAPIO; and (iii) revise the NSC.

Qualifications: Specific international experience in drafting legal documents dealing with seed standards and seeds marketing.

(b) Seed Testing Consultant: Three months in year two and three months in year four to assist NAPIO:

(i) prepare operating manuals for seed testing procedures;

(ii) train the staff to sample and test seeds; and,

(iii) review progress and advise on policy issues.

Qualifications: At least ten years experience as a senior officer with a seed testing agency in the national government of a developed country.

(c) Seed Certification Consultant: This expert would advise and assist the NAPIO Seed Certification Service Director:

(i) establish and operate the Seed Certification Scheme including certification and verification procedures;

(ii) organize and train the SCS staff;

(iii) liaison with the NSC and ORD; and

(iv) prepare operating manuals for seed field inspection and laboratory procedures.

Qualifications: At least ten years experience as a senior officer with a seed certifying authority.

3. General for Consultants

(a) All consultants would be required to be proficient in the English language.

(b) Each consultant shall prepare and submit to the Chief Executive Officer a monthly progress report giving a description of activities, progress of the various phases of his work, problems encountered and measures taken to overcome these problems.

(c) The Consultants in Project Management and in Seed Testing would assist their respective OSPD Chief Executive Officer and NAPIO-SCS Director prepare quarterly, semi-annual and annual reports for submission to the Bank.

4. General for the Republic of Korea: The responsibilities of the Republic of Korea would be as follows:

(a) assign to each consultant a counterpart technician and supporting office and field staff as needed for the prompt execution of the project;

(b) provide, without cost to the consultant, reasonably furnished office accommodations and equipment in Seoul and in the field as needed;

(c) provide transportation or transport vehicles for the use of consultants for their official tours;

(d) provide to the consultant and/or his firm details of all work completed prior to the consultant's arrival;

(e) facilitate prompt clearance through customs of any equipment, material and supplies required for the services and of the personal effects of the Consultant's personnel;

(f) ensure that the Consultant's personnel and their dependents are promptly provided with any necessary entry and exit visas, residence permits, exchange permits and travel documents required for their stay in the territories of the Government;

(g) exempt or bear the cost of, any taxes, duties, fees, levies and other impositions imposed under its laws and regulations or the laws and regulations in effect in its territories or of any political subdivision or agency thereof, on the Consultant and his personnel (other than personnel who are citizens or permanent residents of Korea) in respect of:

(i) any payments made to the Consultant or to such personnel in connection with the carrying out of the agreed to services;

(ii) any equipment, materials and supplies brought into Korea for the purpose of carrying out the services and which, after having been brought into such territories, will subsequently be withdrawn therefrom; and

(iii) any property brought into Korea by the personnel of the Consultant and his dependents for their personal use and which, after having been brought into Korea will subsequently be withdrawn therefrom upon departure of such personnel; however, to qualify for these exemptions, shipment of such property will have to be arranged by contract no later than 3 months after the arrival of the staff member;

5. Necessary Procedure to be Followed by Invited Consulting Firms:

Consulting firms invited to submit proposals are requested to state clearly in their proposals the following:

(a) terms and conditions under which they would carry out the duties and responsibilities specified above; financial terms are not desired at this stage;

(b) the proposed composition of the team which they intend to assign to the project both in the field and at the home office, number of man-months of each individual together with the name and qualifications and experience including proficiency in spoken and written English;

(c) a list of vehicles and equipment which they anticipate would be required in the carrying out of their works; and

(d) the category and number of counterpart personnel and other local staff which they would wish the Government to provide to work with them at no cost to them.

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

DRAFT TERMS OF REFERENCE

FEASIBILITY STUDIES

Okeso Irrigation and Area Development Project
Outline of Additional Studies to be Carried Out

1. Project investigations should be carried out in two phases. The first should be a review of all information already available in existing reports to determine a rational sequence for development of the Lower Geum river basin in step with the overall river basin development program. The review should be based largely on data presented in the 1972 Nippon Koei Consulting Engineers Report on the Geum River Overall Development Project (prepared under contract with the Ministry of Construction), the Okeso Area Agricultural Development Project Report prepared by ADC, and other available data. Additional studies and investigations should also be carried out in connection with the review process as necessary. The main objectives of the review will be to:

(a) determine whether development of the lower basin could proceed independently of the proposed dam construction program in the upper reaches:

(b) reconcile the various proposals for development of the lower Geum river basin area in relation to the basin's overall development plan;

(c) determine a rational sequence for development of the area's land and water resources with due regard to the requirements of all potential users; and

(d) identify a first stage project for immediate development.

2. During the review process particular attention should be given to the following:

(a) present and potential water requirements for power, industry, navigation, domestic and municipal use, and agriculture;

(b) existing and potential water resources, both surface and ground, which could be utilized to meet the various requirements in the Lower Geum basin;

(c) evaluation of the relative merits of various ways to meet the increased demand for water in the Lower Geum basin by:

(i) constructing the Daecheong dam (or one of the alternative dams investigated by Nippon Koei) on the upper reaches of the Geum river and serving the lower basin either by means of a diversion weir at Buyeo and a gravity feeder canal down to the area or by pumping water from the river at Bongjeong;

(ii) enlarging the existing reservoirs in the lower basin and/or reallocating water use from power to irrigation;

(iii) constructing a weir and storage reservoir on the Geum above Gunsan;

(iv) closure of the Mangyeong Dongjin estuary by a sea-dike.

(d) assessment of the impact of alternative water supply sources outlined at (c) above on such aspects as siltation of Gunsan harbor, flooding of agricultural lands, drainage requirements, navigation, road transport, and river embankment protection; and

(e) evaluation of the irrigable land potential on the basis of soil classification, suitability to various types of irrigation, and drainage requirement.

3. A feasibility study should be prepared for the area identified for first stage development during the review process. The study should be prepared in accordance with the FAO Guideline for Preparation of Feasibility Studies. To save time, several of the field investigations required for the feasibility study (e.g. soil surveys, mapping, socio-economic data, etc.) should start concurrently with the overall review.

4. The feasibility study should pay special attention to the following:

(a) review of ADC's organization structure should be carried out and detailed recommendations made regarding the best means of coordinating activities between the different projects being constructed by the agency (including the planning, design, execution, and agricultural development phases of the project). Specific recommendations should also be made regarding training of staff and other steps which ADC could take to improve its overall performance;

(b) preparation of a detailed Ten-Year Agricultural Development Plan along the lines of the Pyongtaek-Kumgang and Yong San Gang projects. The plan should include specific recommendations for the necessary supporting agricultural services together with cost estimates, financing plan, personnel requirements, and an implementation program;

(c) incorporating into the project the area development and community development programs recommended by the UNDP Watershed Management Project (e.g. bench terracing for rainfed development of orchards and field crops along with pasture development on the lower slopes, development of fish ponds, and community improvement schemes);

(d) investment levels and design criteria for on-farm development (land consolidation) should be clearly established, taking into account the present on-going review of the subject by ADC;

(e) preparation of preliminary designs and layout of the irrigation and drainage network with a view to eliminating high cost areas from the project; and

(f) preparation of detailed cost estimates, paying particular attention to the required foreign exchange, physical and price contingency requirements, unit rates for different categories of work, and estimates of work quantities.

September 21, 1973

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

Terms of Reference for the Establishment and Operation of the Office for Seed Production and Distribution

1. Status

OSPD shall be established by amendment to the Seeds Law of 1962 and pursuant to regulations issued thereto operated as a separate unit within the MAF under the direction of a Chief Executive Officer who shall be responsible directly to the Assistant Minister for managing OSPD with due diligence and efficiency and in conformity with sound administrative, agricultural and financial practices.

2. Composition

OSPD shall have a Chief Executive Officer, who shall be acceptable to the Bank, together with such other suitably qualified and experienced technical and administrative officers and staff as may be required for the carrying out of its functions as hereinafter described. The Chief Executive Officer and each of the divisional plant managers (as specified in a staffing plan of OSPD to be approved by the Bank) shall be employed on terms and conditions satisfactory to the Bank.

3. Functions

OSPD shall be exclusively responsible for carrying out the program of the Borrower for the production, processing, packaging and distribution of Certified Seed in the Territories of the Borrower and accordingly shall, without limitation to the foregoing, be responsible:

(a) for the carrying out of Part A of the Project (Schedule 2 of the Loan Agreement) and the operation and maintenance of the facilities, machinery and equipment included therein; and

(b) for the making of arrangements satisfactory to the Bank (i) for the acquisition from ORD or other suppliers of Registered Seed of varieties approved by NSC and inspected by NAPIO in such quantities as shall be required by OSPD, including in the case of the Daegwanryeong seed potato farm of the Gang Weon do Provincial Government, the assumption by OSPD of the management thereof; (ii) with FLIAs or other

appropriate farmers or association of farmers for the multiplication of Registered Seed supplied by OSPD, under the supervision of OSPD and inspection of NAPIO; and (iii) for the distribution by NACF and other appropriate organizations of Certified Seeds, and other commercial seeds, produced and processed by OSPD.

4. Financial

(a) Budgetary Provision;

(i) The Chief Executive Officer shall, prior to the commencement of each fiscal year, prepare an estimate of the capital and operating expenditures (including contingencies) of OSPD to be incurred in such year.

(ii) To enable him to carry out his responsibilities, the expenditure of all amounts appropriate to OSPD in the annual budget of the Borrower (including contingencies) shall be under the control of the chief executive officer who shall be entitled for such purpose, upon prior advice to the Minister, Economic Planning Board, to transfer between categories or groups amounts allocated thereto by such budget.

(iii) Farm machinery provided by the project (except for Part B) shall be operated by OSPD on a for hire basis at such rates as needed to recover all costs including depreciation and interest.

(b) Revolving Fund

(i) OSPD shall establish and maintain a Revolving Fund which at the commencement of the fiscal years 2975, 1976, 1977 and 1978 and each subsequent year shall stand respectively in the amounts of no less than Won 120,000,000, 440,000,000, 1,640,000,000 and 2,160,000,000 (or such other amounts as the Borrower and the Bank may agree), which amounts shall be comprised of cash or other liquid assets, including the seed inventory of OSPD as at each such date, valued at cost.

(ii) OSPD shall draw all monies required to purchase its seed inventory from the Revolving Fund and shall credit thereto the whole or the proceeds of its seed sales less distribution expenses. Save as

mentioned in paragraph (iii) hereof no other drawings or payments shall be made to or from the Revolving Fund.

(iii) In the event that at the commencement of any fiscal year there shall be any surplus in the Revolving Fund over the amount applicable to such date, such surplus shall be available to OSPD for disbursement against operating expenditures incurred by it in such fiscal year or in any subsequent year.

(c) Prices

(i) OSPD shall initiate and maintain operational research studies forthe purpose of (1) evaluating demand for each type and variety of seed to be produced by it in each year; (2) calculating the costs incurred by it in producing such seeds; and (3) assessing seed prices at levels sufficient to recover in full the amount of such production costs. The expression "production costs" shall include expenditures for (A) seed procurement and distribution; (B) operations, maintenance and depreciation on buildings, plant, machinery, equipment and materials used in producing, processing, packaging and distributing seeds; (C) overheads, representing administration, staff and other indirect expenses; (D) interest on borrowings; (E) taxes; and (F) a reasonable return on net capital employed on a long term basis.

(ii) OSPD shall establish and maintain prices at the levels referred to in the foregoing paragraph, provided that the Borrower shall be entitled, in such cases as it shall consider appropriate in terms of national policy, to require OSPD to establish its seed prices, or any of them, at a level lower than the levels herein before referred to.

REPUBLIC OF KOREA
KOREAN SEEDS PROJECT

SUMMARY OF ESTIMATED PROJECT INVESTMENT COSTS AND ANNUAL EXPENDITURES

	Local	Foreign Exchange	Total	Local	Foreign Exchange	Total	Foreign Exchange %	1973	1974	1975	1976	1977	1978
	Won Million			US$ '000				US$ '000					
I. SEED PRODUCTION & PROCESSING (OSPD)													
Land	137	-	137	343	-	343	0.0		343	-	-	-	
Administration	132	9	141	330	25	355	0.0		76	121	113	42	
Buildings	188	400	588	471	1,000	1,471	68.0		19	816	636	-	
Storage	8	181	189	19	453	472	96.0		-	94	189	189	
Machinery and Equipment	67	322	389	167	806	973	82.0		-	231	371	371	
Farm Machinery	16	383	399	40	958	998	96.0		-	669	329	-	
Vehicles	3	76	79	8	189	197	95.9		53	94	50	3	
Office Equipment	9	9	18	22	23	45	51.1		25	20	-	-	
Consultants 1/	-	168	168	-	420	420	100.0		70	110	160	80	
Training	21	12	33	52	31	83	37.3		10	28	33	12	
Revolving Fund (Seeds)	2,160	-	2,160	5,400	-	5,400	0.0		-	300	800	3,000	1,300
Sub-total	2,741	1,560	4,301	6,852	3,905	10,757	36.3		596	2,483	2,681	3,697	1,300
II. REGISTERED SEED PRODUCTION (ORD)													
Farm Machinery & Equipment	2	35	37	4	93	97	96.4		-	97	-	-	
III. SEED CERTIFICATION (NAPIO)													
Land	21	-	21	52	-	52	0.0		-	52	-	-	
Buildings	10	21	31	25	53	78	68.0		-	64	14	-	
Laboratory Equipment	2	39	41	4	98	102	96.1		-	102	-	-	
Vehicles	-	10	10	1	26	27	96.3		-	27	-	-	
Office Equipment	2	2	4	5	5	10	50.0		-	10	-	-	
Consultants	6	60	66	15	150	165	90.9		33	55	44	33	
Training	8	5	13	21	11	32	36.4		11	2	7	12	
Sub-total	49	137	186	123	343	466	73.6		44	312	65	45	
IV. CROP RESEARCH (ORD-USAID PARALLEL FINANCING)	1,200	2,000	3,200	3,000	5,000	8,000	62.5		1,500	2,000	2,000	1,500	1,000
V. FEASIBILITY STUDIES (MAF & ADC)	240	360	600	600	900	1,500	60.0	500	1,000				
VI. CONTINGENCIES 2/													
Physical 10%	68	168	236	169	420	589	71.3		64	257	194	74	
Price: Local 5%	73		73	183		183	0.0		21	63	72	27	
Foreign: 12%	-	499	499	-	1,248	1,248	100.0		24	442	506	276	
Sub-total	141	667	808	352	1,668	2,020	82.6		109	762	772	377	
GRAND TOTAL	4,371	4,759	9,132	10,931	11,909	22,840	52.1	500	3,249	5,654	5,518	5,619	2,300

ANNEX 7
Table 1

1/ Local expenditures for OSPD Consultants are provided for under "Administration"

2/ Contingencies are for items I, II and III only. The amounts given in items IV and V include contingencies.

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

INVESTMENT COST FOR OPPD MAIN OFFICE

	Number of Units	Unit Cost	Annual Expenditures 1974	1975	1976	1977	Total Local	Foreign Exchange	Total
					US$				
I. ADMINISTRATION									
STAFF:									
Managing Director	1	4,000	4,000	4,000	4,000	4,000	16,000	-	16,000
Secretary (Legal)	1	2,500	2,500	2,500	2,500	2,500	10,000	-	10,000
Chief Engineer	1	2,500	2,500	2,500	2,500	2,500	10,000	-	10,000
Assistant Engineers	6	1,400	2,800	8,400	8,400	2,800	22,400	-	22,400
Personnel Officer	1	2,500	1,875	2,500	2,500	1,250	8,125	-	8,125
Accountant	1	2,500	2,500	2,500	2,500	2,500	10,000	-	10,000
Deputy Accountants	2	1,400	2,100	2,800	2,800	1,400	9,100	-	9,100
Legal Officer	1	2,500	2,500	2,500	2,500	-	7,500	-	7,500
Administrator (Org. & Management)	1	2,500	1,250	2,500	2,500	-	6,250	-	6,250
Purchasing Officer	1	2,500	1,875	2,500	2,500	1,250	8,125	-	8,125
Liason Officer	1	2,500	2,500	2,500	2,500	-	7,500	-	7,500
Clerks	4	1,070	2,140	4,280	4,280	1,070	11,770	-	11,770
Secretaries	6	1,200	2,400	7,200	7,200	2,400	19,200	-	19,200
Interpreters	3	1,200	1,200	3,600	3,600	1,200	9,600	-	9,600
Drivers	8	730	2,190	5,840	5,840	1,460	15,330	-	15,330
RENT (600m^2)			3,000	3,000	3,000	1,500	10,500	-	10,500
OFFICE OPERATIONS			2,800	2,800	2,800	2,800	11,200	-	11,200
TRAVEL EXPENSES			13,000	16,000	21,000	13,500	47,625	15,875	63,500
ENGINEERING SERVICES			18,755	37,488	23,945	-	80,188		80,188
Sub-total			71,885	113,408	106,865	42,130	320,413	15,875	336,288
II. VEHICLES									
Cars	8	5,000	25,000	15,000			1,600	38,400	40,000
Car Operations			4,150	6,640	6,640	3,320	10,375	10,375	20,750
Sub-total			29,150	21,640	6,640	3,320	11,975	48,775	60,750
III. OFFICE EQUIPMENT									
Furniture			11,000				5,500	5,500	11,000
Typewriters	15	200	3,000				1,500	1,500	3,000
Sub-total			14,000				7,000	7,000	14,000
IV. CONSULTANTS 1/									
Seed Project Management	3.25	40,000	30,000	40,000	40,000	20,000	-	130,000	130,000
Seed Processing Plant Oper.	2.75	40,000	30,000	40,000	40,000	-	-	110,000	110,000
Agr. Engineer-Farm Machin.	2.0	40,000	10,000	10,000	40,000	20,000	-	80,000	80,000
Agron. Cert.Seed Produc.	2.5	40,000	-	20,000	40,000	40,000	-	100,000	100,000
Sub-total			70,000	110,000	160,000	80,000	-	420,000	420,000
V. TRAINING									
See Table 7) Sub-total			10,000	28,330	32,585	11,560	51,475	31,000	82,475
GRAND TOTAL			195,035	275,378	306,090	137,010	390,863	522,650	913,513

1/ Local expenditures for consultants, estimated at $ 100,000, is included under sections I, III & IV.

ANNEX 7
Table 2

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

INVESTMENT COST FOR SEED PROCESSING PLANTS (FIELD CROPS)

	Number of Units	Unit Cost	ANNUAL EXPENDITURES 1974	1975	1976	1977	TOTAL Local	Foreign Exchange	Total
					US$				
I. LAND									
For Plants (@ 10,000m²)	5	5,000	25,000				25,000		25,000
Subtotal			25,000				25,000		25,000
II. BUILDINGS									
Access Roads & Site Development			6,000	12,000	12,000		9,600	20,400	30,000
Plants (@ 1,300m²)	5	84,500		253,500	169,000		135,200	287,300	422,500
Service Buildings (@ 150m²)	5	9,750		29,250	19,500		15,600	33,150	48,750
Farm Mech: Serv. Buildings (300m²)	5	12,000		36,000	24,000		19,200	40,800	60,000
Service and Installations				50,650	25,000		24,000	51,000	75,000
Subtotal			6,000	381,400	249,500		203,600	432,650	636,250
III. STORAGE									
Bins (80 t)	100	4,000		80,000	160,000	160,000	16,000	384,000	400,000
Bins (20 t)	60	1,200		14,400	28,800	28,800	2,880	69,120	72,000
Subtotal				94,400	188,800	188,800	18,880	453,120	472,000
IV. MACHINERY AND EQUIPMENT									
Weighing in:									
Weighbridge	5	7,750		7,750	15,500	15,500	1,550	37,200	38,750
Precleaning:									
Intake Pit	10	625		1,250	2,500	2,500	250	6,000	6,250
Surge Bin	10	1,000		2,000	4,000	4,000	400	9,600	10,000
De-Awner	10	1,250		2,500	5,000	5,000	500	12,000	12,500
Precleaner	10	3,125		6,250	12,500	12,500	1,250	30,000	31,250
Drying:									
Drier	10	21,250		42,500	85,000	85,000	8,500	204,000	212,500
Automatic Weigher	10	300		600	1,200	1,200	120	2,880	3,000
Processing:									
Seed Cleaner	10	1,000		2,000	4,000	4,000	400	9,600	10,000
Length Separator	10	5,875		11,750	23,500	23,500	2,350	56,400	58,750
Treatment and Packing:									
Seed Treater	10	2,000		4,000	8,000	8,000	800	19,200	20,000
Bag Weigher and Closer	10	2,500		5,000	10,000	10,000	1,000	24,000	25,000
Portable Bag Closer	5	200		200	400	400	40	960	1,000
Miscellaneous:									
Elevator	30	875		5,250	10,500	10,500	1,050	25,200	26,250
Elevator	20	1,000		4,000	8,000	8,000	800	19,200	20,000
Fan Heater Units	20	3,750		15,000	30,000	30,000	3,000	72,000	75,000
Conveyors	10	1,500		3,000	6,000	6,000	600	14,400	15,000
Vacuum Cleaner	5	1,000		1,000	2,000	2,000	200	4,800	5,000
Dust Control Equipment	5	5,000		5,000	10,000	10,000	1,000	24,000	25,000
Spouting Valves, Bypasses, etc.				12,500	25,000	25,000	2,500	60,000	62,500
Install. Supervision 5%				13,580	27,160	27,160	-	67,900	67,900
Install. Labor 10%				27,160	54,320	54,320	135,800	-	135,800
Sub-Subtotal				172,290	344,580	344,580	162,110	699,340	861,450
Spares (10% excl. Bins)				13,155	26,310	26,310	2,630	63,145	65,775
Subtotal				185,445	370,890	370,890	164,740	762,485	927,225
IV. VEHICLES									
4-wheel drive	5	3,125	3,125	6,250	6,250		625	15,000	15,625
Trucks	10	10,000	20,000	40,000	40,000		4,000	96,000	100,000
Motorcycles	10	875	1,750	3,500	3,500		350	8,400	8,750
Subtotal			24,875	49,750	49,750		4,975	119,400	124,375
V. FARM MACHINERY (See Table 5)									
Machinery and Equipment				456,120	304,080		30,408	729,792	760,200
Workshop Equipment	5	12,500		37,500	25,000		2,500	60,000	62,500
Subtotal				493,620	329,080		32,908	789,792	822,700
VI. OFFICE EQUIPMENT									
Typewriters	5	200	200	800			500	500	1,000
Furniture			2,300	9,200			5,750	5,750	11,500
For Laboratory			2,500	10,000			6,250	6,250	12,500
Subtotal			5,000	20,000			12,500	12,500	25,000
RAND TOTAL			60,875	1,224,615	1,188,020	559,690	462,603	2,569,947	3,032,550

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

INVESTMENT COST FOR SEED POTATO PROCESSING PLANTS

	Number of Units	Unit Cost	Annual Expenditures 1974	1975	1976	1977	Total Local	Total Foreign Exchange	Total
					US$				
I. LAND									
For Plants (at 6,000m^2)	5	600	3,000	-	-	-	3,000	-	3,000
Reg. Seed Farm (450 ha)	-	-	315,000	-	-	-	315,000	-	315,000
Sub-Total			318,000	-	-	-	318,000	-	318,000
II. BUILDINGS									
Plants (@ 1,500m^2)	6	127,500	-	382,500	382,500	-	244,800	520,200	765,000
Service Buildings (100m^2)	5	6,500	-	32,500	-	-	10,400	22,100	32,500
Office and Laboratory (200m^2)	1	13,000	13,000	-	-	-	4,160	8,840	13,000
Farm Machinery Service Bldg. (350m^2)	1	14,000	-	14,000	-	-	4,480	9,520	14,000
Electric Installation			200	5,350	4,500	-	3,210	6,840	10,050
Sub-Total			13,200	434,350	387,000	-	267,050	567,500	834,550
III. MACHINERY AND EQUIPMENT									
Grading Equipment	12	2,500	-	30,000	-	-	1,200	28,800	30,000
Weighbridges	2	7,813	-	15,626	-	-	626	15,000	15,626
Sub-Total			-	45,626	-	-	1,826	43,800	45,626
IV. VEHICLES									
Trucks	2	10,000	-	20,000	-	-	800	19,200	20,000
4-wheel drive	1	3,125	3,125	-	-	-	125	3,000	3,125
Motorcycles	10	875	-	8,750	-	-	350	8,400	8,750
Sub-Total			3,125	28,750	-	-	1,275	30,600	31,875
V. FARM MACHINERY (SEE TABLE 5)									
Machinery and Equipment	-	-	-	163,200	-	-	6,528	156,672	163,200
Workshop Equipment	1	12,500	-	12,500	-	-	500	12,000	12,500
Sub-Total			-	175,700	-	-	7,028	168,672	175,700
VI. OFFICE EQUIPMENT									
Typewriters	1	-	200	-	-	-	100	100	200
Furniture	-	-	2,300	-	-	-	1,150	1,150	2,300
For Laboratory	-	-	3,125	-	-	-	1,563	1,562	3,125
Sub-Total			5,625	-	-	-	2,813	2,812	5,625
GRAND TOTAL			339,950	684,426	387,000	-	597,992	813,384	1,411,376

ANNEX 7
Table 4

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

ESTIMATED COST FOR FARM MACHINERY

	No. of Units	Unit Price	Annual Expenditures 1974	1975	1976	1977	Total Local	Total Foreign Exchange	Total
					US $				
I. FOR OSPD FIELD CROPS									
45 hp Tractor	50	5,000		150,000	100,000		10,000	240,000	250,000
Mouldboard Plough - 2 Furrow Reversible	30	1,250		22,500	15,000		1,500	36,000	37,500
Rotavator for 45 hp Tractor - 6 ft. Width Rice Tine	20	1,875		22,500	15,000		1,500	36,000	37,500
Disc Harrow - 8 ft. Tractor Mounted	20	1,125		13,500	9,000		900	21,600	22,500
Tool Carrier	20	3,125		37,500	25,000		2,500	60,000	62,500
Tractor Cage Wheels for Paddy	30	750		13,500	9,000		900	21,600	22,500
Lime Spreader (attachable to trucks)	5	750		2,250	1,500		150	3,600	3,750
Power Sprayer	50	500		15,000	10,000		1,000	24,000	25,000
Blade - Tractor Mounted	10	1,250		7,500	5,000		500	12,000	12,500
Combines - Self Propelled	5	15,000		45,000	30,000		3,000	72,000	75,000
Automatic Threshers	100	500		30,000	20,000		2,000	48,000	50,000
Hydraulic Tipping Trailers	10	1,500		9,000	6,000		600	14,400	15,000
Trailers	15	900		8,100	5,400		540	12,960	13,500
Implement Carriers	5	1,250		3,750	2,500		250	6,000	6,250
Sub-total				380,100	253,400		25,340	608,160	633,500
Spares (20%)				76,020	50,680		5,068	121,632	126,700
Total				456,120	304,080		30,408	729,792	760,200
II. FOR OSPD POTATOES									
45 hp Tractor	12	5,000		60,000			2,400	57,600	60,000
Mouldboard Plough - 2 Furrow Reversible	7	1,250		8,750			350	8,400	8,750
Disc Harrow - 8 ft. Tractor Mounted	7	1,125		7,875			315	7,560	7,875
Tool Carrier	7	3,125		21,875			875	21,000	21,875
Potato Digger Attachments	7	2,000		14,000			560	13,440	14,000
Lime Spreader	7	750		5,250			210	5,040	5,250
Trailers	5	900		4,500			180	4,320	4,500
Implement Carriers	3	1,250		3,750			150	3,600	3,750
Power Sprayers	20	500		10,000			400	9,600	10,000
Sub-total				136,000			5,440	130,560	136,000
Spares (20%)				27,200			1,088	26,112	27,200
Total				163,200			6,528	156,672	163,200
III. FOR PORD SEED FARMS									
35 hp Tractor	5	4,000		20,000			800	19,200	20,000
Mouldboard Plough - 2 Furrow Reversible	5	1,250		6,250			250	6,000	6,250
Rotavator	5	1,500		7,500			300	7,200	7,500
Disc Harrow - 8 ft. Tractor Mounted	5	1,125		5,625			225	5,400	5,625
Tool Carrier	5	3,125		15,625			625	15,000	15,625
Tractor Cage Wheels for Paddy	5	750		3,750			150	3,600	3,750
Power Sprayer	5	500		2,500			100	2,400	2,500
Automatic Threshers	10	500		5,000			200	4,800	5,000
Trailers	5	900		4,500			180	4,320	4,500
Sub-total				70,750			2,830	67,920	70,750
Spares (20%)				14,150			566	13,584	14,150
Sub-total				84,900			3,396	81,504	84,900
Driers	5	1,500		7,500			300	7,200	7,500
Cleaners	5	1,000		5,000			200	4,800	5,000
Sub-total				12,500			500	12,000	12,500
TOTAL PORD				97,400			3,896	93,504	97,400

ANNEX 7
Table 6

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

ESTIMATED COST FOR SEED CERTIFICATION SERVICE (NAPIO)

	No. of Units	Unit Cost	Annual Expenditures 1974	1975	1976	1977	Total Local	Total Foreign Exchange	Total
					US $				
I. LAND									
For Seed Trials (10 ha)	1	50,000		50,000			50,000		50,000
For Buildings (3000 m^2)	1	1,500		1,500			1,500		1,500
Sub-total				51,500			51,500		51,500
II. BUILDINGS									
Seed Testing Laboratory (400 m^2)	1	30,000		30,000			9,600	20,400	30,000
Branch Office Laboratory(100 m^2)	6	6,500		26,000	13,000		12,480	26,520	39,000
Electrical Installations				4,550	200		1,520	3,230	4,750
Engineering Services (5.5%)				3,330	726		1,306	2,750	4,056
Sub-total				63,880	13,926		24,906	52,900	77,806
III. LABORATORY EQUIPMENT									
Main Laboratory				97,500			3,900	93,600	97,500
Branch Laboratories				4,500				4,500	4,500
Sub-total				102,000			3,900	98,100	102,000
IV. OFFICE EQUIPMENT									
Typewriters	8	200		1,600			800	800	1,600
Furniture				8,250			4,125	4,125	8,250
Sub-total				9,850			4,925	4,925	9,850
V. VEHICLES									
Car	1	5,000		5,000			200	4,800	5,000
4-Wheel Drives	7	3,125		21,875			875	21,000	21,875
Sub-total				26,875			1,075	25,800	26,875
VI. CONSULTANTS									
Seed Certification	3	44,000	22,000	44,000	44,000	22,000	12,000	120,000	132,000
Seed Testing	0.5	44,000		11,000		11,000	2,000	20,000	22,000
Legislation	0.25	44,000	11,000				1,000	10,000	11,000
Sub-total			33,000	55,000	44,000	33,000	15,000	150,000	165,000
VII. TRAINING									
(See Table 7) Sub-total			11,390	1,980	6,770	11,970	21,110	11,000	32,110
GRAND TOTAL			44,390	311,085	64,696	44,970	122,416	342,725	465,141

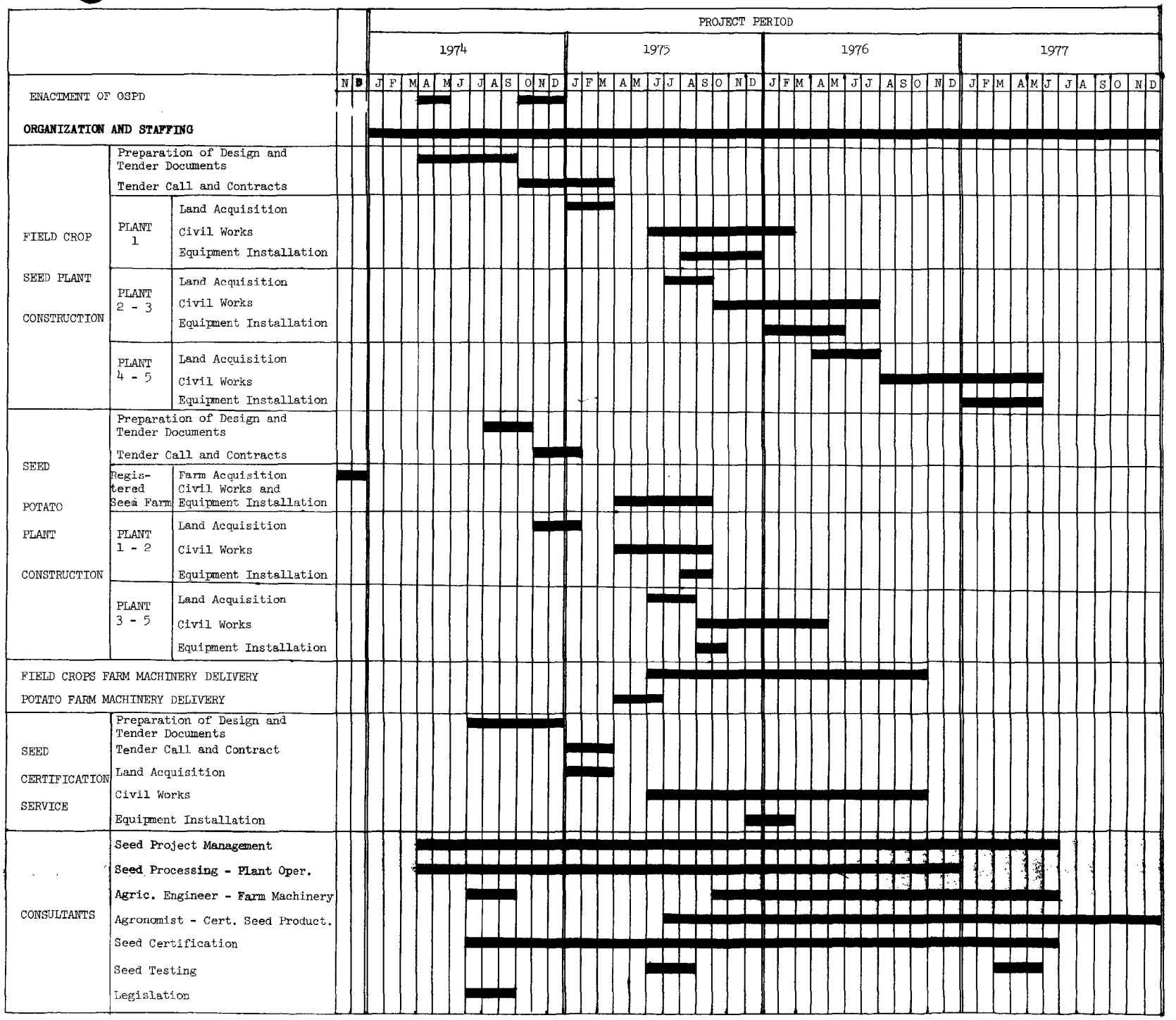
PUBLIC OF KOREA

KOREAN SEEDS PROJECT

ESTIMATED COST TRAINING PROGRAM

	Number of Persons	Cost per Person	Annual Expenditures 1974	1975	1976	1977	TOTAL Local	Foreign Exchange	Total
					US$				
OSPD TRAINING									
I. INTERNATIONAL									
Chief Executive Officer					6,000			6,000	6,000
Seed Processing Section Chief			5,000					5,000	5,000
Potato Processing Section Chief			5,000					5,000	5,000
Selected Staff				5,000	5,000	5,000		15,000	15,000
II. AT SUWEON									
Plant Managerial Staff	15	195		1,950	975		2,925		2,925
Potato Managerial Staff	2	195		390			390		390
Chief Guidance Officers	6	195		780	390		1,170		1,170
Guidance Officers	44	135		675	2,025	3,240	5,940		5,940
III. AT PLANTS									
Plant Managerial Staff	15	300		3,000	1,500		4,500		4,500
Potato Managerial Staff	2	300		600			600		600
Chief Guidance Officers	6	50		200	100		300		300
Guidance Officers	44	45		225	675	1,080	1,980		1,980
P.Z. Leaders				1,000	2,500	2,000	5,500		5,500
Driers, Packers, Graders etc.	90	200		9,000	9,000		18,000		18,000
Engineers	6	300		1,200	600		1,800		1,800
Mechanics	6	250		1,000	500		1,500		1,500
Tractor Drivers	124	50		3,100	3,100		6,200		6,200
Subtotal			10,000	28,120	32,365	11,320	50,805	31,000	81,805
IV. LOCAL TRAVEL COSTS	67	10		210	220	240	670		670
TOTAL			10,000	28,330	32,585	11,560	51,475	31,000	82,475
NAPIO TRAINING									
I. INTERNATIONAL									
Director	1	6,000	6,000					6,000	6,000
SCS Section Head	1	5,000	5,000					5,000	5,000
II. AT SUWEON									
Certificate Officer: Summer Crops	41	195		390	2,730	4,875	7,995		7,995
Winter Crops	37	195			1,755	5,460	7,215		7,215
Potato	10	195	390	390	585	585	1,950		1,950
Analysts	6			1,200	1,700	1,050	3,950		3,950
TOTAL			11,390	1,980	6,770	11,970	21,110	11,000	32,110
GRAND TOTAL			21,390	30,310	39,355	23,530	72,585	42,000	114,585

ANNEX 7
Table 7



REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

CONSTRUCTION SCHEDULE

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

TIME SCHEDULE FEASIBILITY STUDIES

Description	1973						1974											
	8	9	10	11	12		1	2	3	4	5	6	7	8	9	10	11	12
Preparation of field investigation																		
Field investigation																		
Planning and optimization																		
Preparation of feasibility study																		
Final submission																		

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

PROCUREMENT OF EQUIPMENT AND MATERIALS

A. Contracts to be awarded following international competitive bidding

TENDER 1:

Alternative tenders for a turn-key contract and groups of items as described below in general terms:

Five field crop seed processing plants including: buildings, site development and equipment:

1. BUILDINGS	QUANTITY	ESTIMATED COST US$
(a) Access roads and site development	5	30,000
(b) Plant buildings for seed processing and storage, at 1,300 m^2 each	5	422,500
(c) Service Buildings (150 m^2 each)	5	48,750
(d) Farm Machinery Service Buildings (300 m^2)	5	60,000
(e) Services and Installations		75,000
	Sub-total	636,250

2. EQUIPMENT	DESCRIPTION	CAPACITY	QUANTITY	ESTIMATED COST US$
Weighbridge	Surface table 2.8 m x 8 m with gross and printout	20 tons	5	38,700
Intake Pit	1/8" steel reinforced reception hopper with grate and elevator pit	5 tons	10	16,000

EQUIPMENT	DESCRIPTION	CAPACITY	QUANTITY	ESTIMATED COST US$
Elevator	Bucket type, centrifugal discharge, heavy metal construction, with hopper intake, complete with 3 hp motor, mounts gear boxes and fiber washer distance pieces on buckets, exact length to be specified in engineering design	20 t.p.h.	20	40,000
Elevator	As above, with 2 hp	10 t.p.h.	30	50,000
Surge Bin	Steel, hopper bottomed with flow control gate and self-cleaning	10 ton	10	10,000
De-Awner	Multiple steel beat-rotating among stationary arms, 20 hp motor	20 t.p.h.	10	25,000
Precleaner	With aspiration, flat screen or reel type, complete with 7-1/2 hp motor mounts and dust collectors	20 t.p.h.	10	31,250
Drier	Continuous flow drier of a design suitable for seed drying. Self cleaning. Drier equipped with cooling section. Diesel oil fired furnace incorporating full atomization by compressed air, electric ignition, automatic temperature control by thermostat.	10 t.p.h.	10	212,500
Automatic Weigher	Net-weigher enclosed in dust-proof casing equipped with counter. Bottom valve or tipping bucket type	15 t.p.h.	10	25,000

EQUIPMENT	DESCRIPTION	CAPACITY	QUANTITY	ESTIMATED COST US$
Seed-Cleaner	Air and screen cleaner - 4 or 5 screen. Roll feed hopper, adjustable aspirations. Complete with 10 hp motors, mounts belts and extra screens	4 t.p.h.	10	60,000
Length Separator	Indented cylinder or disc type, sizes for paddy and other cereals. 3,000 x 700 mm 3 hp motor with variator	4 t.p.h.	10	58,750
Seed Treater	For applying fungicides in liquid and/or slurry form. Complete with dual motoring devices, electric motor drive and agitation tank	5 t.p.h.	10	20,000
Bag Weigher & Closer	Automatic or semi-automatic bagger to weigh and fill paddy in 5 kg bags at 480 per hour up to 30 kg bags at 100 per hour to within 0.3%. Closer to heat seal 6 mil plastic bags. To be thermostatically controlled, heavy duty		10	25,000
Portable Bag Closer	Heavy duty type for closing cloth and paper bags		5	1,000
Bins	Concrete or metal bins, galvanized steel, perforated floor with air-sweep bottom to permit rapid and complete emptying. Closed top with inspection panel and ladders	80 tons	100	400,000
Bins	Same as above	20 tons	60	72,000

EQUIPMENT	DESCRIPTION	CAPACITY	QUANTITY	ESTIMATED COST US$
Fan Heater Units	Centrifugal backward curved fan, 1,000 - 1,500 cfm at 7 ins. w.g. theater to deliver up to 500,000 Btu per hour with low heat turn down. Units to be supplied with controls for regulating temperature and humidity of air entering plenum chamber		20	75,000
Conveyors	Horizontal conveyors to load and unload bins, belt type on trough-shaped rollers. Suitable design and length in accordance to final layout. Enclosed auger type for collection to bagging of waste material	20 t.p.h.	10	30,000
Vacuum Cleaner	Industrial type complete with attachments		5	5,000
Dust Control Equipment	A central system to remove dust from each machine operating within the plant		5	25,000
Miscellaneous	Spouting valves, bypasses, etc.			62,500
Installation				67,900
Spares	On equipment excluding storage bins			48,625
		Sub-total		1,399,225
		Grand Total		2,035,475

ANNEX 9
Table 2

TENDER 2a

SEED POTATO PROCESSING EQUIPMENT

	DESCRIPTION	CAPACITY	QUANTITY	ESTIMATED COST US$
Weighbridge	Surface table 2.8 m x 8 m with gross and tare printout		2	15,626
Grading Equipment	Metal frame construction, fixed or road wheels. Three sizes of output. Rubber belt feed elevator with rubber slats, feed hopper (200 kgs). Grader with two screens - fixed or chain (sizes to be decided at final design). Variable speed drive, adjustments for slope. Rubber protection to reduce damage to potatoes. Elevator for small size rejects - to be bagged for disposal. Roller inspection tables with at least two speeds. Heavy duty plastic rollers spaced about 0.5 inch apart. Bagging - off boxes for paper and or straw bags. Lighting equipment over inspection table. Motors and starters. Semi-automatic weigher, receiving hopper, rubber web elevator, platform scale (100 kgs) with fixed bag holder with 'inch' or fine feed control. 1 hp motor and starter. Potato brusher, metal frame, with rubber brushing rollers, motor and starter	5 t.p.h.	12	30,000
		Sub-total		45,626

TENDER 2b SEED POTATO PLANTS

a)	Buildings for storage and processing at 1,500 m^2 each	6	765,000
b)	Service buildings (100 m^2)	5	32,500
c)	Office and Laboratory (200 m^2)	1	13,000
d)	Farm machinery service building (350 m^2)	1	14,000
e)	Electrical Installations		10,050
	Sub-total		834,550
	TOTAL (a and b)		880,176

ANNEX 9
Table 3

TENDER 3

FARM MACHINERY EQUIPMENT

DESCRIPTION	QUANTITY	ESTIMATED COST US$
Tractor - 45 hp	62	310,000
- 35 hp	5	20,000
Mouldboard Plough - 2 Furrow Reversible	42	52,500
Rotavator - For 45 hp tractor 6 ft width rice tine	20	37,500
- Same as above for 35 hp tractor	5	7,500
Disc Harrow - 8 ft tractor mounted	32	36,000
Tool Carrier - 10 ft 2-1/4 sq inch tool bar, with 3 stiff standards, 3 corrugator shovels and grain and fertilizer drill attachments	32	100,000
Tractor Cage Wheels for Paddy	35	26,250
Lime Spreader - Attachable to Trucks	12	9,000
Power Sprayer - Knapsack	75	37,500
Blade - Tractor mounted	10	12,500
Combine - Self propelled, about 3 meters width. Equipped for rice harvest	5	75,000
Automatic Thresher	110	55,000
Trailer - for grain and input transportation	25	22,500
Hydraulic tipping trailer	10	15,000
Implement Carrier	8	10,000
Potato Digger, Attachments - One row, tractor mounted suitable for all row widths	7	14,000
Workshop Equipment - for repair and service of equipment and machinery at six locations	6	75,000
Spares - 20% on all farm machinery and equipment		168,050
TOTAL		1,083,300

ANNEX 9
Table 4

TENDER 4

VEHICLES

ITEM	QUANTITY	ESTIMATED COST US$
4-wheel drive short chassis	13	40,625
2-wheel drive passenger car	9	45,000
Motorcycles	20	17,500
Trucks - with 6-tons bulk loading capacity. Tipping	12	120,000
TOTAL		223,125

TENDER 5

SEED CERTIFICATION EQUIPMENT

DESCRIPTION	QUANTITY
Moisture Unit	
Non-corrosive metal dishes (thickness 0.5 mm). 46 mm Ø	100
Electrically heated oven with temperature control at 130° + 3 C, to reach required temperature within 30-45 minutes following opening and loading with dishes	1
Drying oven - size 26 liters to hold 30 dishes with mechanical ventilation	1
Dessiccator with suitable desiccant - 21 cm internal diameter	2
Balance - weighings made in grams to 3 places of decimals	1
Grinding mill, made from non-water absorbent materials, seed and ground seed should be protected from air, grinding should be even and not at high speed	1
Crucible tongs	1
Cleaning Unit	
Small pilot plant clipper - one 1/4 hp motor 1,500 revs/min to drive sieve-shaking mechanism. One 1/8 hp, 1,500 revs/min from driving blower (150-3,000 revs/min) complete set of sieves (round hole and slits)	1
Tachometer	1
Set of indented cylinders - 1/4 hp motor with 6-8 cylinder mantles	1
Set of shallow metal trays	1
Set seed sieves and stand	1

DESCRIPTION	QUANTITY
Subsampling Unit	
Sample divider (soil type or similar) with three receiving pans, one larger pan, shallow tray spatula and various sized spoons	1
Various types of small containers for subsamples and sample fractions both paper and plastic bags and for reuse. Cleaning utensils including hand blower (connected to air pressure system)	3,000
Weighing Unit	
Analytical balance - capacity 160 g, read 0.05 mg	1
Precision balance - capacity 800 g read 1 mg	1
Set weighing beakers and scoops	1
Blowing Unit	
Seed Blower	1
Purity Test	
Diaphanoscope	1
Binocular microscope - 1.6x, and with paired wide-field oculars 10x, resolving power better than 3 microns	1
Monocular magnifier - 3x linear enlargement 2-1/2	1
Binocular magnifier - (goggles) linear enlargement 2-1/2	1
Metal spatulas, curved forceps, scalpel needles, funnel shaped scoop	1 set
Containers	1 set
Crop seeds and weed seed collection	1 set
Wet Room - Germination Tests	
Refrigerator - range 0° - 15°C	1
Drying Oven - a stainless steel lined, temperature range electrically heated 25° - 40°C (+1°C)	2

DESCRIPTION	QUANTITY
Sand - pass through holes of 0.8 m x retained on 0.05 mm - ph 6.07 - 7.5	2
Blotting paper - 0.6 mm thick, 8-k9 cm Ø	1
Vacuum Counting Device - vacuum pump to displace 450 - 550 cubic decimeters of free air per minute, hose, line, connections and counting heads	1
Counting Boards: Jacobsen Apparatus (Copenhagen table) capacity 22 x 8 seed beds, automatic temperature regulation 10 - 10°C, high day/low night temperature switching combined with light	3
Cabinet type germination for temperature variation (15 - 20°C) capacity 2 x 10 x 8 = 160 standard sand pans on 20 stainless steel shelves	4
Bunker for waste sand - stainless steel - 100 x 65 x 50 cm	1
Aluminium sand trays with lids 18 swg. 150 mms dia (top) 126 mms dia (base) 40 mms deep, complete with flat plate	250
Thermostat - brass jacket 100°-500°C for check on sand sterilization	1
Thermostat - max/min reading	1
Distilled water apparatus	1
Storage bottles - distilled water	1
TOTAL ESTIMATED COST	US$ 102,000

ANNEX 9
Table 6

B. Contracts to be awarded following local bidding

TENDER 6

	BUILDINGS	QUANTITY	ESTIMATED COST US$
(a)	Seed Testing Station - at 400 m^2	1	30,000
(b)	Branch Offices Local for Seed Certification at 100 m^2	6	39,000
(c)	Services and Installations		9,000
	TOTAL		78,000

ANNEX 10
Table 1

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

ESTIMATED SCHEDULE OF DISBURSEMENTS

Bank Fiscal Year and Quarter	Actual	Cumulative Disbursement at end of Quarter
	US$ Million	
1973-74		
September 30, 1973	0.1	0.1
December 31, 1973	0.1	0.2
March 31, 1974	0.1	0.3
June 30, 1974	0.25	0.55
1974-75		
September 30, 1974	0.30	0.85
December 31, 1974	0.35	1.20
March 31, 1975	0.15	1.35
June 30, 1975	0.10	1.45
1975-76		
September 30, 1975	0.65	2.10
December 31, 1975	0.80	2.90
March 31, 1976	0.50	3.40
June 30, 1976	0.75	4.15
1976-77		
September 30, 1976	0.80	4.95
December 31, 1976	0.55	5.50
March 31, 1977	0.50	6.00
June 30, 1977	0.25	6.25
1977-78		
September 30, 1977	0.25	6.50
December 31, 1977	0.25	6.75
March 31, 1978	0.25	7.00

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

RECURRENT COSTS AND REVENUES

A. Estimated Cash Flow for OSPD (Table 1)

Inflow

(a) The IBRD Bank Loan inflow was based on the estimated foreign exchange expenditures as given in Annex 7.

(b) The OSPD Capital includes the local share of the investment costs and provision for the Revolving Fund.

(c) Revenues from seed sales and farm machinery charges are detailed in Tables 2 and 7, respectively.

Outflow

(a) Investment Costs are detailed in Annex 7, Table 1 and includes contingencies.

(b) Recurrent Costs are detailed in Tables 3, 4, 5 and 6.

General

(a) Project effective date of January 1, 1974 and investment costs as given in Annex 7.

(b) Fiscal year of January 1 to December 31.

B. Estimated Revenues from Seed Sales (Table 2)

These calculations assume that from each 127.5 kgs of field crop grain of 16% moisture equivalent delivered to the OSPD processing plant 5.5 kgs are lost in drying and handling, 22 kgs are separated into Grade D during fine cleaning and sold as feed grain and 100 kgs would be packaged as Certified or Commercial seed. To obtain 100 kgs of Certified seed potato the seed grower would deliver 115 kgs; 3 kgs are lost in drying and 12 kgs are graded out for non-seed use. Prices for each type of marketable product are given.

C. Recurrent Costs for OSPD Main Office (Table 3)

These costs are for the OSPD main office at Seoul and include staff and office expenditures incurred for the operation of the seed business. Costs of this type incident to project construction are given in Annex 7, Table 2, as investment costs and are not included here.

D. Estimated Recurrent Costs for Processing Plant (Tables 4 and 5)

Seed plant operating costs including the cost of seed procurement are given here. Seed producers would be paid in the basis of 16% moisture equivalent delivery to the seed plant and adjusted by laboratory analysis for the estimated component of certified seed, clean out of admixtures and Grade D. The 1972 base prices for each grade (Table 2) plus a 10% incentive payment for paddy seed and a 20% premium on other seed meeting certification standards were used to calculate costs.

E. Estimated Recurrent Cost of Seed Distribution (Table 6)

These estimates were based on costs provided by NACF.

F. Factors for Farm Machinery Operating Costs and Charges (Table 7)

These data were developed from information provided by the MAF and the mission's estimates of probable life and costs. These costs would be recovered from seed grower-users at the hourly or hectare rates given.

G. Budget for NAPIO Incurred by OSPD Operations (Table 8)

These recurring costs are for operating the Seed Certification Service inspection, laboratory analysis and labelling activities incident to the marketing of OSPD Certified seed. The rates paid NAPIO by OSPD for these services would cover NAPIO's costs and would be recovered from the sale of Certified seed.

Table 9: Paddy Seed/Regular Barley Seed Rotation

The estimates are for a 20 hectare unit where paddy would be followed by 15 hectares of regular barley. Farming operations, which were all done by manual labor and animal drawn power before the project, would be partly mechanized at full development.

Land preparation and lime spreading for both paddy and barley as well as seeding and fertilizing for barley would be fully mechanized, while harvesting would be done partly by manual labor and partly by self-propelled combines. Trailers instead of animal drawn carts would be used for transport of inputs, implements and agricultural produce. More labor would be used for rogueing.

The cost estimates before the project were based on surveys conducted by the Korean Institute of Agricultural Economics and on the data furnished in the Yearbook of Agriculture and Forestry Statistics, MAF for 1972.

It is envisaged that at full development paddy and regular paddy yields would be 5 and 3 tons respectively as against the national average yields of 4.3 and 2.6 tons respectively. The net income per hectare at full development would be about US$1,198 per hectare as against US$884 before the project, giving an increment of US$314 per hectare.

Table 10: Paddy Seed Crop Per Hectare

The assumptions and basis of calculations are more or less the same as for Table 9.

The net income per hectare at full development would be about US$912 as against US$735 before the project, giving an increment of US$717.

Table 11: Naked Barley Seed Crop Per Hectare

The assumptions and basis of calculations are more or less the same as for Table 9.

The net income per hectare at full development would be about US$303 as against US$208 before the project, giving an increment of US$95.

Table 12: Wheat Seed Crop Per Hectare

The assumptions and basis of calculations are more or less the same as for regular barley in Table 9.

The net income per hectare at full development would be about US$222 as against US$121 before the project, giving an increment of about US$101.

Table 13: Soybeans Seed Crop Per Hectare

Farming operations currently performed by manual labor and drawn animal power would be partly mechanized at full development. Land preparation, seed drilling and fertilizing would be mechanized and transport of inputs, implements and agricultural produce would be by tractor-trailer. Other operations would be by manual labor.

This net income per hectare at full development would be about US$232 as against US$72 before the project, giving an increment of about US$160.

Table 14: Potato Registered Seed Farm - 450 Ha

The estimates are for field operations only and exclude salaries and allowances of permanent staff. To produce disease free seed, potato is grown on the same land only once in three years. Therefore the annual area under potato would remain at 150 hectares. However, with the provision of 2 tractors and equipment, it should be possible to increase the area under maize, oilseeds and wheat to 100, 50 and 100 hectares respectively, about double the hectarage before the project.

The net income per hectare would be about US$375 as against US$169 before the project, giving an increment of US$206.

Table 15: Seed Potato Crop

Farming operatives, which are performed by manual labor and animal drawn power would be partly mechanized. Land preparation, lime spreading and potato digging would be mechanized, and transport of inputs, implements and harvested crop would be done by tractor drawn trailers.

The average yield per hectare at full development would be about 15 tons as against the national average of 10.6 tons before the project. The net income per hectare at full development would be US$833 as against US$489 before the project, giving an increment of US$344.

Table 16: Incremental Value Per Hectare with Project Seeds

On the basis of field trails and investigations conducted by ORD, it is envisaged that crops grown with project seeds would give an average yield increase of about 6% for paddy, 12% each for regular barley, naked barley, and wheat, 10% of soybeans and 50% for potato.

After allowing for added costs, the increment per hectare would be about US$45 for rice, US$29 for regular barley, US$34 for naked barley, US$25 for wheat, US$9 for soybeans, and US$253 for potato.

September 21, 1973

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

ESTIMATED CASH FLOW FOR OSPD

	1974	1975	1976	1977	1978	1979	1980	1981-1998
	US$ '000							
A. Bank Loan	195	2,280	2,153	909				
B. Local Investment	501	540	483	159				
C. Revolving Fund	0	300	800	3,000	1,300			
D. Revenues From								
Sales of Certified Seed		139	895	3,300	5,813	7,243	7,243	7,243
Sales of Commercial Seed			637	1,648	643			
Sales of D Grade		9	176	585	706	726	726	726
Sales of Registered Seed		45	152	213	236	236	236	236
Farm Machinery Gharge - Field Crops		24	190	268	268	268	268	268
- Potato		11	25	30	38	38	38	38
Total Inflow	696	3,348	5,511	10,112	9,004	8,511	8,511	8,511
II. OUTFLOW								
A. Investment Cost	696	2,820	2,636	1,068				
B. Recurrent Cost For:								
Main Office		31	61	61	70	70	70	70
Processing Plants	6	560	3,689	5,176	5,254	5,254	5,254	5,254
Field Crops								
Processing Plants	17	374	776	952	1,180	1,180	1,180	1,180
Potato								
Distribution - Field Crops			146	437	510	510	510	510
- Potato		18	65	141	234	234	234	234
Total Outflow	719	3,803	7,373	7,835	7,248	7,248	7,248	7,248
I - II. BALANCE BEFORE LOAN SERVICE	(23))	(455)	(1,862)	(2,277	1,756	1,263	1,263	1,263
III. LOAN SERVICE								
Interest (7 1/4%)		15	185	347	415	415	415	
Annuity (18 years)								575
I-II-III BALANCE								
ACCUMULATED BALANCE Dec.31	(23)	(470)	(2047)	1930	1,341	848	848	688
Lowest Point in Cash	(23)	(493)	(2540)	(610)	731	1,579	2,427	
Balance During Year - Usually November	((23)	(493)	(2766)	(1198)	4	924	1,744,	

ANNEX II
Table 1

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

ESTIMATED REVENUES FROM SEED SALES

	Grade B Price 1972	1975 Mark Up: 120 % on Potato Tons	1975 Sales Price-US$	1976 Mark Up: 120% on Potato, 40% on Field Crops Tons	1976 Sales Price-US$	1977 Mark Up: 140% on Potato 50% on Field Crops Tons	1977 Sales Price-US$	1978 Mark Up: 160% on Potato 60% on Field Crops Tons	1978 Sales Price- US$	1979-1998 Mark Up: 160% on Potato 65% on Field Crops Tons	1979-1998 Sales Price - US$
					US$						
I. CERTIFIED SEED											
Paddy											
Certified Seed	206			500	144,000	4,450	1,375,050	9,000	2,970,000	11,000	3,740,000
Commercial Seed	206			1,000	288,000	4,450	1,281,600	2,000	576,000		
D Grade	184			326	62,918	1,930	372,490	2,384	460,112	2,384	460,112
Regular Barley											
Certified Seed	118			650	107,250	1,700	300,900	2,500	472,500	2,500	487,500
Commercial Seed	118			850	140,250	800	132,000				
D Grade	105			326	33,578	542	55,826	542	55,826	542	55,826
Naked Barley											
Certified Seed	133			650	120,900	1,700	340,000	2,500	532,500	2,500	547,500
Commercial Seed	133			850	158,100	800	148,800				
D Grade	118			326	37,816	542	62,872	542	62,872	542	62,872
Wheat											
Certified Seed	122			200	34,200	600	109,800	1,000	195,000	1,000	201,000
Commercial Seed	122			300	51,300	400	68,400				
D Grade	109			109	11,663	218	23,326	218	23,326	218	23,326
Soybeans											
Certified Seed	224					50	16,800	300	107,400	500	185,000
Commercial Seed	224					50	16,800	200	67,200		
D Grade	199					22	4,598	109	22,781	109	22,781
Potatoes											
Certified Seed	74	850	163	3,000	489,000	6,500	1,157,000	8,000	1,536,000	10,850	2,083,200
D Grade	74	102	84	360	30,240	780	65,520	960	80,640	1,200	100,800
Total:											
Certified Seed			138,550		895,350		3,299,550		5,813,400		7,243,200
Commercial Seed					637,650		1,647,600		643,200		
D Grade			8,568		176,215		584,632		705,557		725,717
GRAND TOTAL:			147,118		1,709,215		5,531,782		7,162,157		7,968,917
II. REGISTERED SEED											
Paddy		15	412	6,180	90	412	37,080	110	412	45,320	110	412	45,320	110	412	45,320
Regular Barley					50	236	11,800	81	236	19,116	81	236	19,116	81	236	19,116
Naked Barley					50	266	13,300	81	266	21,546	81	266	21,546	81	266	21,546
Wheat					14	244	3,416	28	244	6,832	28	244	6,832	28	244	6,832
Soybeans					7	448	3,136	34	448	15,232	34	448	15,232	34	448	15,232
Potatoes		350	111	38,850	750	111	83,250	950	111	105,450	1,150	111	127,650	1,150	111	127,650
TOTAL:				45,030			151,982			213,496			235,696			235,696

ANNEX 11
Table 2

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

RECURRENT COSTS FOR OSPD MAIN OFFICE

	Number of Units	Unit Cost	1974	1975	1976	1977	1978	1979-1998 per year
					US$			
I. SALARIES 1/								
Chief Executive Officer	1	4,000					4,000	4,000
Secretary (Legal)	1	2,500		1,250	2,500	2,500	2,500	2,500
Administration: Chief	1	2,500		1,250	2,500	2,500	2,500	2,500
Admin. Officer	1	1,400		700	1,400	1,400	1,400	1,400
Marketing: Chief	1	2,500		1,250	2,500	2,500	2,500	2,500
Assistants	2	1,400		1,400	2,800	2,800	2,800	2,800
Finance: Treasurer	1	2,500		1,250	2,500	2,500	2,500	2,500
Admin. Officers	2	1,400		1,400	2,800	2,800	2,800	2,800
Seed Prod.: Chief	1	2,500		1,250	2,500	2,500	2,500	2,500
Procurement Officer	2	1,400		700	1,400	1,400	1,400	1,400
Seed Processing: Chief	1	2,500		1,250	2,500	2,500	2,500	2,500
Admin. Officers	2	1,400		1,400	2,800	2,800	2,800	2,800
Farm Machinery: Chief	1	2,500		1,250	2,500	2,500	2,500	2,500
Engineers	2	1,400		1,400	2,800	2,800	2,800	2,800
Service Pool: Clerks	6	1,070		3,210	6,420	6,420	6,420	6,420
Typists	6	750		2,250	4,500	4,500	4,500	4,500
Drivers	2	730		730	1,460	1,460	1,460	1,460
Subtotal				21,940	43,880	43,880	47,880	47,880
II. OFFICE EXPENSES								
Rent (15 m^2/pers)	29	75		1,090	2,175	2,175	2,175	2,175
Supplies, Telephone, etc.				5,000	10,000	10,000	13,150	13,150
Travel Exp. (Int. flights)				1,050	2,100	2,100	2,100	2,100
Car Operations	2	830		830	1,660	1,660	1,660	1,660
Subtotal				7,970	15,935	15,935	19,085	19,085
III. MAINTENANCE AND REPLACEMENT								
Office Supplies (10%)				700	1,400	1,400	1,400	1,400
Vehicle Replacement							1,500	1,500
Subtotal				700	1,400	1,400	2,900	2,900
TOTAL				30,610	61,215	61,215	69,865	69,865

ANNEX 11
Table 3

1/ This is just to cover operating functions, for incremental functions see Annex 7.

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

ESTIMATED RECURRENT COST FOR PROCESSING PLANTS (FIELD CROPS)

	Number of Units	Unit Cost Per Year	1974	1975	1976	1977	1978-1998
				US$			
I. SALARIES							
Managers	5	1,700	-	850	4,250	8,500	8,500
Deputy Managers	5	1,400	-	700	3,500	7,000	7,000
Dryer/Packer Oper.	15	800	-	1,200	9,600	12,000	12,000
Intake/Cleaning Oper.	15	800	-	1,200	9,600	12,000	12,000
Casual Labour	7.5	700	-	525	4,200	5,250	5,250
Procurement Officers	5	1,070	-	525	4,280	5,350	5,350
Clerks	5	1,070	-	3,210	12,840	16,050	16,050
Laboratory Officers	5	1,200	-	600	4,800	6,000	6,000
Laboratory Assist.	5	1,100	-	2,200	5,500	5,500	5,500
Drivers	5	730	-	730	2,920	3,650	3,650
Chief Guid. Officers	5	1,200	-	2,400	3,600	6,000	6,000
Guidance Officers	35	1,070	-	14,980	22,470	37,450	37,450
Subtotal			-	29,120	87,560	124,750	124,750
II. PROCESSING COSTS							
Chemical Treatment/ton	17,500	2.50	-	-	12,500	37,500	43,750
Packing: Rice/ton	11,000	5.50	-	-	8,250	48,950	60,500
Barley,Wheat & Soybean/ton	6,500	3.60	-	-	12,600	21,960	23,400
Heating & Power	-	-	-	6,560	54,750	75,500	75,500
Transportation/ton	22,310	0.10	-	191	1,594	2,231	2,231
Subtotal			-	6,751	89,694	186,141	205,381
III. REPAIRS, MAINT. & REPLACEMENT							
Plant Repair (5%)	-	-	-	-	16,870	84,347	84,347
Plant Replacement 1/	-	-	-	-	-	-	41,800
Vehicle Replacement 2/	-	-	-	-	-	-	16,700
Subtotal			-	-	16,870	84,347	142,847
IV. OFFICE EXPENSES							
For Office	-	-	-	6,000	18,000	30,000	30,000
For Lab. Exp.	-	-	-	4,000	12,000	20,000	20,000
Local Taxes & Insurance	-	-	-	3,450	15,860	18,930	18,930
Subtotal			-	13,450	45,860	68,930	68,930
V. FARM MACHINERY OPERATIONS	-	-	-	20,202	168,378	235,725	235,725
VI. SEED CERT. CHARGE							
Field Inspection/ha	7,013	5.0	-	3,004	23,042	35,066	35,066
Official Sampling/ton	17,500	0.50	-	750	5,750	8,750	8,750
Certific. Tagging/ton	17,500	0.50	-	750	5,750	8,750	8,750
Subtotal			-	4,504	34,542	52,566	52,566
VII. SEED PROCUREMENT							
Registered Seed	-	-	6,180	68,732	108,046	108,046	108,046
Certified Seed	-	-	-	347,310	2,624,580	3,603,150	3,603,150
D Grade	-	-	-	69,920	521,565	712,505	712,505
Subtotal			6,180	485,962	3,254,191	4,423,701	4,423,701
TOTAL			6,180	559,989	3,688,935	5,176,160	5,253,900

1/ Includes replacement of elevators, precleaners, De-awners and chemical treators every tenth year, and replacement of cleaners, surge bins, driers, weigher and packers, bins, heaters and fans every fifteenth year.

2/ Replacement every sixth year.

REPUBLIC OF KOREA

:/

KOREAN SEEDS PROJECT

ESTIMATED RECURRENT COSTS FOR SEED POTATO PLANTS

	Number of Units	Unit Cost per Year	1974	1975	1976	1977	1978-1998
			US$				
I. STAFFING							
Manager	1	1,450	1,450	1,450	1,450	1,450	1,450
Deputy Manager	1	1,200	1,200	1,200	1,200	1,200	1,200
Foremen	6	1,070	1,070	3,210	6,420	6,420	6,420
Farm workers - Graders	10	800	4,000	8,000	8,000	8,000	8,000
Clerks	2	1,070	1,070	2,140	2,140	2,140	2,140
Typist	1	750	750	750	750	750	750
Driver	1	730	730	730	730	730	730
Chief Guidance Office	1	1,200		1,200	1,200	1,200	1,200
Guidance Officers	9	1,070		3,210	6,420	9.630	9,630
Casual Labor	12.5	700		3,000	4,500	8,750	8,750
Subtotal			10,270	24,890	32,810	40,270	40,270
II. PROCESSING COSTS							
Straw Bags	11,500	3	1,725	12,765	25,200	31,000	34,500
Fuel & Power (Estimate))			400	1,330	1,330	1,330	1,330
Repairs & Maintenance (10%)				4,563	4,563	4,563	4,563
Collection of Seed	15,000	0.10	60	450	840	1,050	1,500
Subtotal			2,185	19,108	31,933	37,943	41,893
III. REPLACEMENT							
Equipment (10%)							4,563
Vehicles 1/							1,900
Subtotal							6,463
IV. OFFICE EXPENSES							
Laboratory			1,250	2,500	3,000	3,000	3,000
Office			500	3,300	6,600	6,600	6,600
Subtotal			1,750	5,800	9,600	9,600	9,600
V. FARM MACHINERY OPERATIONS				14,471	31,354	38,590	48,237
VI. SEED CERTIF. CHARGE							
Field Inspection/ha	940	5.00	490	1,480	3,060	3,860	4,700
Official Sampling/ton	12,000	1.00	1,150	3,500	7,250	9,170	12,000
Certific. Tagging/ton	10,850	1.00	850	3,000	6,500	8,000	10,850
Subtotal			2,490	7,980	16,810	21,030	27,550
VII. SEED PROCUREMENT							
Certified Seed				275,010	595,855	733,360	916,700
Grade D				26,640	57,720	71,040	88,800
Subtotal				301,650	653,575	804,400	1005,500
TOTAL			16,695	373,899	776,082	951,833	1,179,513

1/ Replacement every six years.

KOREAN SEEDS PROJECT

ESTIMATED RECURRENT COST OF SEED DISTRIBUTION

	1974	1975	1976	1977	1978-1998
			US$		
FIELD CROPS					
Plant to wholesaler					
Handling	-	-	14,987	44,960	52,456
Truck Transportation	-	-	7,350	22,050	25,725
Railway Transportation	-	-	7,841	23,523	27,445
Sub-Total	-	-	30,178	90,533	105,672
Wholesaler to retailer					
Handling	-	-	5,037	15,112	17,631
Truck Transportation	-	-	5,907	17,721	20,675
Storage and Insurance	-	-	2,900	8,700	10,150
Sub-Total	-	-	13,844	41,533	48,456
NACF Commission	-	-	82,690	248,070	289,429
TOTAL	-	-	126,712	380,136	443,511
Overhead (15%)	-	-	19,007	57,020	66,527
GRAND TOTAL	-	-	145,721	437,156	510,038
POTATO					
Plant to Wholesaler					
Handling	-	2,547	8,993	19,484	32,523
Truck Transportation	-	1,093	4,410	9,555	13,962
Railway Transportation	-	1,576	5,572	12,073	20,126
Sub-Total	-	5,216	18,975	41,112	66,611
Wholesaler to retailer					
Handling	-	856	3,023	6,549	10,931
Truck Transportation	-	1,239	4,307	9,333	15,822
Storage and Insurance	-	493	1,740	3,770	6,293
Sub-Total	-	2,588	9,070	19,652	33,046
NACF Commission	-	8,137	28,733	62,254	103,916
TOTAL	-	15,941	56,778	123,018	203,573
Overhead (15%)	-	2,391	8,517	18,453	30,536
GRAND TOTAL	-	18,332	65,295	141,471	234,109

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

FACTORS FOR FARM MACHINERY OPERATING COSTS AND CHARGES

	Expected Life (Years)	Cost Per Unit	Annual Depreciation Charge	Annual Interest Charge @ 7½%	Operating Cost/hr				Per Year hrs/ha	Annual Variable Costs	Annual Fixed Costs	Annual Total Costs	Unit Costs Per Hr	Unit Costs Per Ha 1/	Suggested Rates Per Hr.	Suggested Rates Per Ha 1/
					POL	R & M	Labor	Total								
					US$											
Tractor 45 hp	10	5,000	500	363	0.41	0.65	0.50	1.56	1,000/ -	1,560	863	2,423	2.42/ -		2.60/ -	
Plough	10	1,250	125	91	-	.07	.10	.17	500/150	85	225	310	0.61/10.10		0.70/11.00	
Disc	10	1,125	113	37	-	.13	.10	.23	500/150	115	150	265	.53/ 9.83		0.60/11.00	
Rotavator	8	1,875	234	136	-	.36	.10	.46	500/150	230	370	600	1.20/12.07		1.30/13.00	
Tool carrier and attachment (ridger, cultivator/grain-fert.drill)	10	3,125	313	227	-	.20	.10	.30	500/250	150	540	690	1.38/ 7.60		1.50/ 8.50	
Leveling Blade	10	1,250	125	91	-	.40	.10	.50	200/ -	100	216	316	1.56/ -		1.70/ -	
Paddy Cage Wheels	8	750	94	54	-	.15	.10	.25	500/ -	125	148	273	0.55/ -		0.60/ -	
Hydraulic Tip-Trailer	10	1,500	150	109	-	.21	.10	.31	100/ -	31	259	290	2.90/ -		3.00/ -	
Farm Trailer	10	900	90	65	-	.15	.10	.25	100/ -	25	155	180	1.80/ -		2.00/ -	
Implement Carrier	10	1,250	125	91	-	.15	.10	.25	50/ -	13	216	229	4.58/ -		5.00/ -	
Potato Digger	10	2,000	200	145	-	.15	.30	.45	200/100	90	345	435	2.18/ 9.20		2.50/10.00	
Combine/Self-Propelled	10	15,000	1,500	1,088	0.60	3.00	0.60	4.20	320/200	2,100	2,588	4,688	14.65/23.44		16.00/25.00	
Automatic Thresher	8	500	63	36	0.08	.17	.15	.32	400/ -	128	99	227	0.57/ -		0.70/ -	
Power Sprayer	8	500	63	36	0.10	.20	.10	.30	250/ -	75	99	174	0.70/ -		0.80/ -	
Lime Spreader (Truck Type)	8	750	94	54	-	.30	.10	.40	250/ -	100	148	248	1.00/ -		1.10/ -	

1/ Includes tractor.

ANNEX 11
Table 7

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

BUDGET FOR NAPIQ INCURRED BY KNSC OPERATIONS

	Number of Units (Man Years)	Unit Cost	1974	1975	1976	1977	1978-1998 Per Year
				US$			
I. REVENUES							
From Field Crop Certif.	-	-	-	4,504	34,542	52,566	52,566
From Potato Certif.	-	-	2,490	7,980	16,810	21,030	27,850
Total			2,490	12,484	51,352	73,596	80,416
II. COSTS							
A. SALARIES							
Administration							
Director	0.25	1,900	-	475	475	475	475
Clerk	0.5	1,070	-	300	535	535	535
Typist	0.5	750	-	375	375	375	375
Field Supervision							
Section Head	1	1,400	-	1,400	1,400	1,400	1,400
Agronomist	1	1,100	-	550	1,100	1,100	1,100
Clerks	3	1,070	-	1,070	2,140	3,210	3,210
Typist	1	750	-	375	750	750	750
Driver	1	750	-	375	750	750	750
Branch Offices							
Inspectors - Field Crops	11	1,070	-	3,210	7,490	11,770	11,770
- Potatoes	2.5	1,070	1,070	1,070	1,605	2,675	2,675
Section Head - Potato	1	1,400	700	1,400	1,400	1,400	1,400
Analyst - Potato	1	1,200	600	600	1,200	1,200	1,200
Clerks	6	1,070	-	2,140	4,280	6,420	6,420
Seed Testing							
Section Head	1	1,400	-	1,400	1,400	1,400	1,400
Analysts	6	1,200	-	1,200	3,600	7,200	7,200
Clerk	1	1,070	-	535	1,070	1,070	1,070
Typist	1	750	-	375	750	750	750
Sub-Total			2,370	16,850	30,320	42,480	42,480
B. OFFICE EXPENSES & FUEL							
Main Office	-	-	-	750	1,500	1,500	1,500
Field Supervision Office	-	-	-	2,000	3,000	3,000	3,000
Branch Offices	-	-	-	1,000	3,500	6,000	6,000
Seed Testing	-	-	-	2,000	4,000	6,000	6,000
Sub-Total			-	5,750	12,000	16,500	16,500
C. MAINTENANCE OF BUILDINGS AND EQUIPMENT							
Seed Testing (10%)	-	-	-	6,840	13,680	13,680	13,680
Branches (5%)	-	-	-	1,500	3,000	3,000	3,000
Sub-Total		-	-	8,340	16,680	16,680	16,680
TOTAL COSTS			2,370	30,940	59,000	75,660	75,660
BALANCE			150	(18,456)	(7,648)	(2,064)	4,756

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

PADDY SEED/REGULAR BARLEY SEED ROTATION

ESTIMATED REVENUES AND COSTS FOR A 20 HECTARE UNIT - (PZ)
(At Full Development)

	Before Project					After Project				
	Area Planted Ha	Yield Ton/Ha	Quantity Tons	Price Won/Ton	Amount Won Million	Area Planted Ha	Yield Ton/Ha	Quantity Tons	Price Won/Ton	Amount Won Million
I. REVENUES										
(a) Paddy - Seed	20	4.3	86	82,400	7.086	20	5.0	80	98,800	7.904
- Reject								20	73,600	1.472
(b) Straw	"	6.3	126	7,800	0.983	"	7.0	140	7,800	1.092
(c) Regular Barley - Seed	15	2.6	39	47,200	1.841	15	3.0	36	56,800	2.045
Reject								9	42,000	.378
(d) Straw		3.3	49.5	4,600	.228		3.8	57	4,600	.262
Total					10.138					13,153
	Unit	Unit/Ha	Quantity	Won/Unit	Amount Million Won	Unit	Unit/Ha	Quantity	Won/Unit	Amount Million Won
II. COSTS - A. LABOR										
1. Paddy	Man Days	110	2,210	500	1.105	Man Days	60	1,200	500	.600
	Woman Days	26	520	300	.156	Woman Days	26	520	300	.156
	Animal Days	14	280	800	.224	Animal Days	2	4	800	.032
	Machines					Machines				.850
2. R. Barley	Man Days	53	795	500	.398	Man Days	20	300	500	.150
	Woman Days	57	855	300	.257	Woman Days	15	225	300	.022
	Animal Days	6	90	800	.072	Animal Days				.068
	Machines					Machines				.636
Sub-total (A)					2.212					2.514
B. INPUTS										
1. Seed - Paddy	Kg	40	800	82.4	.066	Paddy Kg	40	800	164.8	0.132
Barley	Kg	65	975	47.2	.046	Barley	65	975	94.4	0.092
2. Fertilizer - N.	Kg		3,240	66	.214	N.		3,900	66	.257
P.	Kg		1,660	42	.070	P.		1,660	42	.070
K.	Kg		990	19	.019	K.		1,500	19	.029
3. Manure	Ton		280	630	.176	Manure Ton		300	630	.189
4. Chemicals					.111	Chemicals				.133
5. Irrigation			20 ha	7,590	.152	Irrigation		20 ha	7,590	.152
Sub-total (B)					.854					1.054
Total Costs					3.066					3,568
III. NET - INCOME					7,072					9,585
					US$17,680					US$23,962
				US$ Per ha	US$ 884.00				US$ Per ha	1,198.10
									Increment US$	314.10

Annex 11
Table 9

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

PADDY SEED CROP - ESTIMATED REVENUES AND COSTS PER HECTARE
(At Full Development)

	Before Project				After Project			
	Unit	Quantity	Price Won/Unit	Amount Won	Unit	Quantity	Price Won/Unit	Amount Won
I. REVENUES								
(a) Seed	Tons	4.3	82,400	354,320	Tons	4	98,800	395,200
(b) Reject	Tons					1	73,600	73,600
(c) Straw	Tons	6.3	7,800	49,140		7	4,600	32,200
Total				403,460				501,000
II. COSTS -								
A. LABOR								
	Man Days	110	500	55,000		60	500	30,000
	Woman Days	26	300	7,800		26	300	7,800
	Animal Days	14	800	11,200		2	800	1,600
	Machines							52,500
Sub-total (A)				74,000				91,900
B. INPUTS								
1. Seed	Kg	40	82.4	3,296		40	164.8	6,592
2. Fertilizer - N	Kg	100	66	6,600		120	66	7,920
P	Kg	58	42	2,436		70	42	2,940
K	Kg	28	19	532		35	28	980
3. 3. Manure	Tons	8	630	5,040		10	630	6,300
4. Chemicals				10,040				12,000
5. Irrigation				7,590				7,590
Sub-total (B)				35,534				44,322
Total Costs				109,534				136,222
III. NET INCOME				293,926				364,778
			US$ Per Ha	735			US$ Per Ha	912
							Increment US$	177

Annex 11
Table 10

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

NAKED BARLEY SEED CROP - ESTIMATED REVENUES AND COSTS PER HECTARE
(At Full Development)

	Before Project				After Project			
	Unit	Quantity	Price Won/Unit	Amount Won	Unit	Quantity	Price Won/Unit	Amount Won
I. REVENUES								
(a) Seed	Ton	2.7	53,200	143,640	Ton	2.7	64,000	172,800
(b) Reject						0.6	47,200	28,320
(c) Straw	Ton	2.3	4,600	10,580	Ton	3.3	4,600	15,180
Total				154,220				216,300
II. COSTS -								
A. LABOR								
	Man Days	53	500	26,500		20	500	10,000
	Woman Days	57	300	17,100		27	300	8,100
	Animal Days	7	800	5,600				
	Machines							46,600
Sub-total (A)				49,200				64,700
B. INPUTS								
1. Seed	Kg	65	53.2	3,460		65	106.4	6,920
2. Fertilizer - N	Kg	100	66	6,600		120	66	7,920
P	Kg	70	42	2,940		90	42	3,780
K	Kg	40	19	760		60	19	1,140
3. Manure	Ton	10	630	6,300		12	630	7,560
4. Chemicals	Kg	1.5	1,190	1,785		2.5	1,190	2,975
Sub-total (B)				21,845				30,295
Total Costs				71,045				94,995
III. NET INCOME				83,175				121,305

US$ Per Ha 207.94

US$ Per Ha 303.30
Increment US$ 95.36

Annex 11
Table 11

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

WHEAT SEED CROP - ESTIMATED REVENUES AND COSTS PER HECTARES
(At Full Development)

	Before Project					After Project				
	Area Planted Ha	Yield Ton/Ha	Quantity Tons	Price Won/Ton	Amount Won	Area Planted Ha	Yield Ton/Ha	Quantity Tons	Price Won/Ton	Amount Won
I. REVENUES										
(a) Grain - Seed	1	2.2	2.2	48,800	107,360	1	3.0	2.4	58,400	140,160
- Reject								0.6	43,600	26,160
(b) Straw		2.4		4,600	11,040		3.0	3.0	4,600	13,800
					118,400					180,120
	Unit	Unit/Ha	Quantity	Won/Ton	Amount Won	Unit	Unit/Ha	Quantity	Won/Ton	Amount Won
II. COSTS-										
A. LABOR										
	Man Days	58	58	500	29,000		20	20	500	10,000
	Woman Days	56	56	300	16,800		29	29	300	8,700
	Animal Days	7	7	800	5,600					
	Machines									46,500
Sub-total (A)					51,400					65,200
B. INPUTS										
1. Seed	Kg	55	55	49	2,695	Kg	55	55	98	5,390
2. Fertilizer - N	Kg	80	80	66	5,280	Kg	100	100	66	6,600
P		60	60	42	2,520	Kg	70	70	42	2,940
K		40	40	19	760	Kg	45	45	19	855
3. Manure	Ton	9	9	630	5,670	Ton	12	12	630	7,560
4. Chemical	Kg	1.5	1.5	1,190	1,785	Kg	2.5	2.5	1,190	2,975
Sub-total (B)					18,710					26,320
Total Costs					70,110					91,520
III. NET INCOME					48,290					88,600
				US$ Per Ha	120.73				US$ Per Ha	221.50
									Increment US$	100.77

Annex 11
Table 12

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

SOYBEANS SEED CROP - ESTIMATED REVENUES AND COSTS PER HECTARE

	Before Project				After Project			
	Unit	Quantity	Price Won/Unit	Amount Won	Unit	Quantity	Price Won/Unit	Amount Won
I. REVENUES								
Yield - Seeds	Ton	0.8	89,600	71,680	Ton	1.2	107,600	129,120
- Reject						0.3	79,600	23,880
- Straw		2.5	4,600	11,500		2.6	4,600	11,960
				83,180				164,960
II. COSTS -								
A. LABOR								
	Man Days	32	500	16,000		24	500	12,000
	Woman Days	51	300	15,300		36	300	10,800
	Animal Days	5	1,000	5,000				
	Machines							21,000
Sub-total (A)				36,300				43,800
B. INPUTS								
1. Seed	Kg	54	90	4,860	Kg	54	180	9,720
2. Fertilizer - N	Kg	25	66	1,650	Kg	30	66	1,980
P	Kg	75	42	3,150	Kg	90	42	3,780
K	Kg	100	19	1,900	Kg	120	19	2,280
3. Manure (Ashes)	Ton	2.5	2,160	5,400	Ton	4	2,160	8,640
4. Chemicals	Kg	1	1,190	1,190	Kg	1.5	1,190	1,785
Sub-total (B)				18,150				28,185
Total Costs (A + B)				54,450				71,985
III. NET INCOME				28,730				92,975
				US$ 71,83				US$ 232.44
								Increment US$ 160.61

Annex 11
Table 13

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

POTATO REGISTERED SEED FARM - 450 HA

ESTIMATED REVENUES AND COSTS

	Before Project					After Project				
	Area Planted Ha	Yield Ton/Ha	Quantity Tons	Price Won/Unit	Amount Million Won	Area Planted Ha	Yield Ton/Ha	Quantity Ton	Price Won/Unit	Amount Million Won
I. REVENUES										
(a) Potato (a) Seed	150	10	1,500	29,600	44.400	150	15	2,000	35,600	71.200
(b) Reject								250	29,600	7.400
(b) Corn	50	1.8	90	40,000	3.600	100	2	200	40,000	8.000
(c) Oilseeds	25	1.0	25	80,000	2.000	50	1.5	75	80,000	6.000
(d) Wheat	50	2.5	125	43,600	5.450	100	3	300	43,600	13.080
(e) Fallow	175					50				
Total Revenues	450				55.450	450				105.680

	Unit	Unit/Ha	Quantity	Won/Unit	Amount Million Won	Unit	Unit/Ha	Quantity	Won/Unit	Amount Million Won
II. COSTS (A) LABOR										
1. Potato	Man Days	57	8,550	500	4.275		29	4,350	500	2.175
	Woman Days	68	10,200	300	3.060		60	9,000	300	2.700
	Animal Days	11	1,400	800	1.12					-
	Machines				0.44					5.052
2. Other Crops	Man Days	47	5,875	500	2.938		27	6,750	500	3.375
	Woman Days	57	7,125	300	2.137		38	9,500	300	2.850
	Animal Days	9	1,125	500	.563					-
	Machines				-					4.096
Sub-total (a)					14.533					20.248
(B) INPUTS										
1. Seed - Potato	Tons	1	150	29,600	4.44	Ton	1	150	59,200	8.880
- Others	Kg				0.766					1.351
2. Fertilizer - N	Kg	85	23,375	66	1.543	N Kg		34,350	66	2.267
P	Kg	75	20,625	42	0.866	P Kg		28,350	42	1.191
K	Kg	70	19,250	19	0.366	K Kg		26,100	19	0.496
3. Manure	Tons	11	3,025	630	1.906	Tons		4,400	630	2.772
4. Chemicals					0.600					1.000
Sub-total (b)					10.487					17.957
Total Costs					25.020					38.206
III. NET INCOME					30.430					67.475

US$76,075.00
US$ Per ha 169
of farm area

US$168,688.00
US$ Per ha 375
Increment 206

Annex 11
Table 14

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

POTATO SEED CROP - ESTIMATED REVENUES AND COSTS PER HECTARE

	Before Project				After Project			
	Unit	Quantity	Price Won/Unit	Amount Won	Unit	Quantity	Price Won/Unit	Amount Won
I. REVENUES								
Yield - Seed	Ton	10.6	29,600	313,760	Ton	13	35,600	462,800
- Reject						2	29,600	59,200
			1,570	1,570				2,200
Total				315,330				524,200
II. COSTS -								
A. LABOR								
	Man Days	57	500	28,500		40	500	20,000
	Woman Days	68	300	20,400		60	300	18,000
	Animal Days	11	800	8,800				
	Machines							50,520
Sub-total (A)				57,700				88,520
B. INPUTS								
1. Seed	Ton	1	29,600	29,600		1	59,200	59,200
2. Fertilizer - N	Kg	90	66	5,940		110	66	7,260
P	Kg	90	42	3,780		100	42	4,200
K	Kg	110	19	2,090		140	19	2,660
3. Manure	Ton	11.2	630	7,056		14	630	8,820
4. Chemicals				13,450				20,200
Sub-total (B)				61,916				102,340
Total Costs				119,616				190,860
III. NET INCOME				195,714				333,340
				US$ 489.28				US$833.35
								Increment -US$344.07

Annex 11
Table 15

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

INCREMENTAL VALUE PER HA GROWN WITH PROJECT SEEDS

	Paddy		Regular Barley		Naked Barley		Wheat		Soybeans		Potato	
	Change	US$	Change	US$	Change	US$	Change	US$	Change	US$	Change	US$
I. ADDED VALUE												
Base Yield (tons)	4.3		2.6		2.7		2.2		0.80		10.6	
Yield Increase	6%		12%		12%		12%		10%		50%	
Added Production (tons)	0.26		0.31		0.32		0.26		0.08		5.30	
Price (1972 Grade B)$	206		118		133		122		224		74	
Total Added Value		53.56		36.58		42.56		31.72		17.92		392.20
II. ADDED COSTS												
Seeding Rate (kg/ha)	40		65		65		55		54		1,000	
Seed Cost Increase (US$/kg)	0.13		0.08		0.09		0.08		0.15		0.12	
Added Seed Cost		5.20		5.20		5.85		4.40		8.10		120.00
Added Cost for Harvesting and Threshing		3.21		2.20		2.55		1.90		1.08		19.61
Total Added Cost		8.41		7.40		8.40		6.30		9.18		139.61
Incremental Value/Ha		45.15		29.18		34.16		25.42		8.74		252.59
Incremental Value in Won/Ha		18,060		11,672		13,664		10,168		3,496		101,036

Annex 11
Table 16

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

ECONOMIC AND FINANCIAL RATES OF RETURN

A. Economic Rate of Return

1. The incremental revenue used to calculate the economic rate of return was based on the assumption that a farmer using project Certified seed would obtain yield increases of 6% for paddy, 12% for barley and wheat, 10% for soybeans and 50% for potato. These yield increases were based on ORD research and similar research and farmer experience in other countries. The high rate used for potato reflects the advantages of disease free seed and the current low yields for this crop.

2. Prices used were provided by the Bank's Economic Analysis and Projections Department and represent 1980 projected international prices cif Korean ports without discount for inflation. Prices used were US$135/ton for polished rice, US$85/ton for naked barley, US$75/ton for regular barley, US$80/ton for wheat, US$130/ton for soybeans and US$74/ton for potato.

3. The detailed calculations of incremental revenue as given in Table 1 were based on the tons of Certified seed projected for sale, the area it would sow at current Korean seeding rates and the value of incremental production at the above yield responses and prices.

4. The cost stream included the project investment costs for crop research (ORD-USAID) and the OSPD investment and annual recurring costs, excluding price contingencies, less the commercial grain value of the Certified seed. This deduction represents the farmer-user's before project cost for seed. The added cost for harvesting, threshing and marketing of the increased production was not deducted as it would be equalized by benefits derived by the farmer saving his own seed from the crop produced by the project Certified field crop seeds. However, potato seed would need replacement each year to control seed borne diseases.

5. The economic rate of return would be 47.6%. Details are given in Table 2. Sensitivity tests were applied after assuming that yield increases would be only 50% and 25% of the above. The results were as follows:

	Yield Increases (As Given in Para 1)		
	100%	50%	25%
Basic Analysis	47.6	22.7	5.0
15% higher investment costs	40.7	19.4	3.7
25% lower volume seed sales	38.2	17.3	1.9
15% higher costs and 25% lower sales volume	32.8	14.9	0.6
Without seed potato	37.1	17.3	1.9

The project is moderately sensitive to costs, sales volume and the inclusion of seed potato and highly sensitive to yield increase rates achieved from the use of Certified seed. Thus it would be desirable for the crop research component to continue to provide new higher yielding varieties for multiplication and distribution by the OSPD.

September 21, 1973

REPUBLIC OF KOREA

KOREAN SEEDS PROJECT

BENEFITS ORIGINATING FROM INCREASED YIELDS BY USE OF CERTIFIED SEED

	1975	Benefit	1976	Benefit	1977	Benefit	1978	Benefit	1979	Benefit	1980- 1998	Benefit
						US $						
PADDY												
Seed used - tons	-		500		4,450		9,000		11,000		11,000	
Area Planted (40kg/ha)	-		12,500		111,250		225,000		275,000		275,000	
Present Yield (3.1 ton/ha Polish)	-		38,750		344,875		697,500		852,500		852,500	
6% Yield Increase tons	-		2,325		20,693		41,850		51,150		51,150	
Added Value at US$135 ton				313,875		2,793,555		5,649,750		6,905,250		6,905,250
NAKED BARLEY												
Seed used - tons	-		-		650		1,700		2,500		2,500	
Area Planted (65kg/ha)	-		-		10,000		26,154		38,462		38,462	
Present Yield (2.7 ton/ha)	-		-		27,000		70,616		103,847		103,847	
12% Yield Increase	-		-		3,240		8,474		12,462		12,462	
Added Value at US$85 ton						275,400		720,290		1,059,270		1,059,270
REGULAR BARLEY												
Seed used - tons	-		-		650		1,700		2,500		2,500	
Area Planted (65kg/ha)	-		-		10,000		26,154		38,462		38,462	
Present Yield (2.6 ton/ha)	-		-		26,000		68,000		100,001		100,001	
12% Yield Increase	-		-		3,120		8,160		12,000		12,000	
Added Value at US$75 ton						234,000		612,000		900,000		900,000
WHEAT												
Seed used - tons	-		-		200		600		1,000		1,000	
Area Planted (55kg/ha)	-		-		3,636		10,909		18,182		18,182	
Present Yield (2.2 ton/ha)	-		-		7,999		24,000		40,000		40,000	
12% Increase	-		-		960		2,880		4,800		4,800	
Added Value at US$80 ton						76,800		230,400		384,000		384,000
SOYBEANS												
Seed used - tons	-		-		50		300		500		500	
Area Planted (54kg/ha)	-		-		926		5,556		9,259		9,259	
Present Yield (0.8 ton/ha)	-		-		741		4,445		7,407		7,407	
10% Yield Increase	-		-		74	[illegible]	445		741		741	
Added Value at US$130 ton						9,620		57,850		96,330		96,330
POTATO												
Seed used	850		3,000		6,500		8,000		10,850		10,850	
Area Planted (1,000kg/ha)	850		3,000		6,500		8,000		10,850		10,850	
Present Yield (10.6 ton/ha)	9,010		31,800		68,900		84,800		115,010		115,010	
50% Yield Increase	4,505		15,900		34,450		42,400		57,505		57,505	
Added Value at US$74 ton		333,370		1,176,600		2,549,300		3,137,600		4,255,370		4,255,370
TOTAL ADDED VALUE		333,370		1,490,475		5,938,675		10,407,890		13,600,220		13,600,220

ANNEX 12
Table 1

REPUBLIC OF KOREA

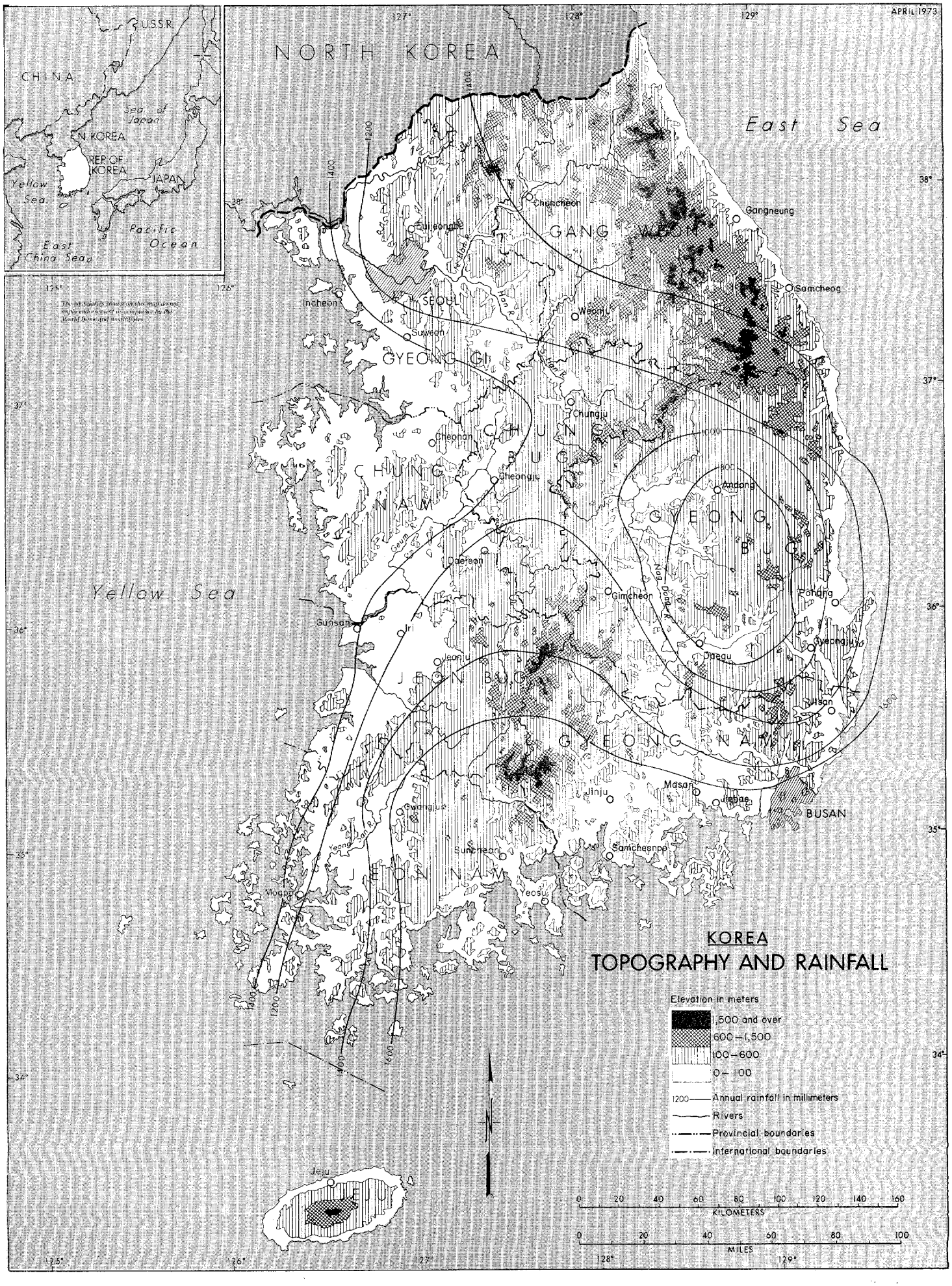
KOREAN SEEDS PROJECT

ESTIMATE OF ECONOMIC RATE OF RETURN

	1974	1975	1976	1977	1978	1979	1980-1998
	US $'000						
I. ADDED VALUE FROM (SEE TABLE 1)							
Paddy			314	2,794	5,650	6,905	6,905
Naked Barley				275	720	1,059	1,059
Regular Barley				234	612	900	900
Wheat				77	230	384	384
Soybeans				10	58	96	96
Potato		333	1,177	2,549	3,138	4,255	4,255
TOTAL ADDED VALUE		333	1,491	5,939	10,408	13,599	13,599
II. ADDED COSTS							
Research (USAID)	1,500	2,000	2,000	1,500	1,000		
Investment (Excl. Price Contingency)	714	2,826	2,130	816			
Procurement, processing and distribution cost	23	238	1,006	1,948	2,173	2,173	2,173
TOTAL ADDED COSTS	2,237	5,064	5,136	4,264	3,173	2,173	2,173
III. ECONOMIC RATE OF RETURN	47.6%						

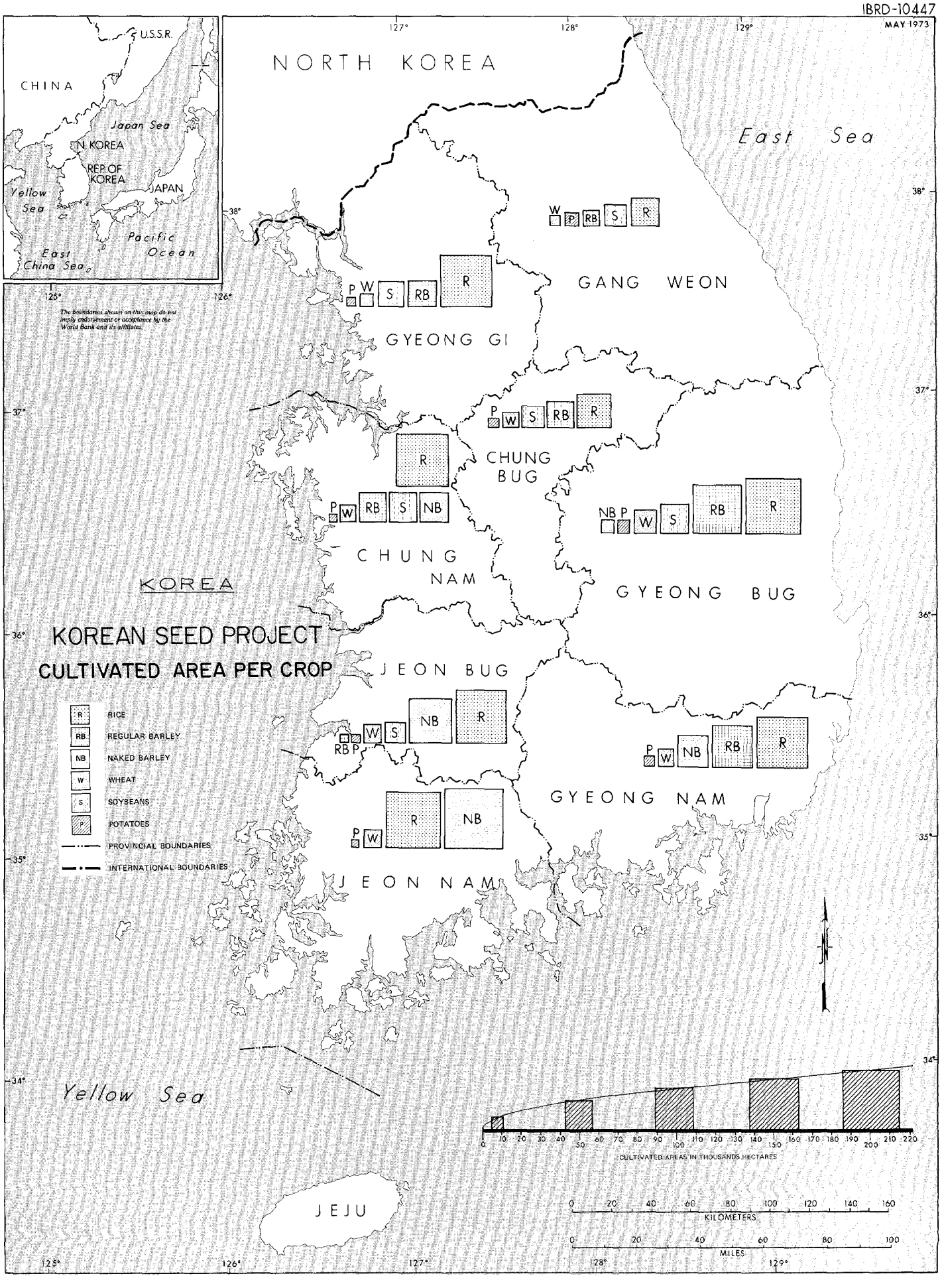
ANNEX 12
Table 2

IBRD 10376
APRIL 1973



IBRD-10447

MAY 1973



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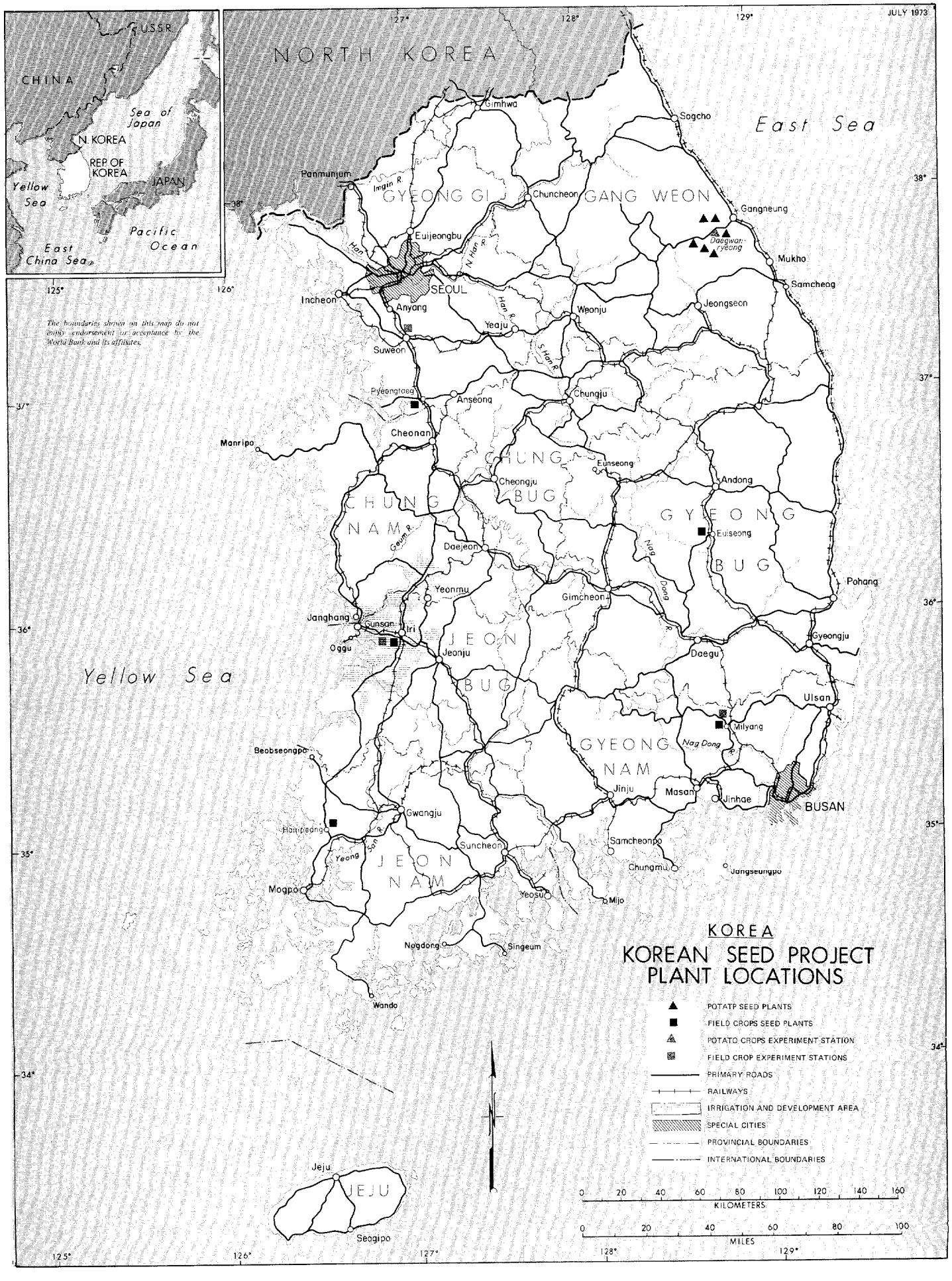
JULY 1973
U.S.S.R.
CHINA
Sea of Japan
N. KOREA
REP. OF KOREA
JAPAN
Yellow Sea
Pacific Ocean
East China Sea
NORTH KOREA
East Sea
Yellow Sea
Gimhwa
Sogcho
Panmunjum
Imgin R.
GYEONG GI
Chuncheon
GANG WEON
Gangneung
Daegwallyeong
Euijeongbu
Han R.
N. Han R.
Mukho
Samcheog
SEOUL
Incheon
Anyang
Yeaju
Weonju
Jeongseon
S. Han R.
Suweon
Pyeongtaek
Anseong
Chungju
Manripo
Cheonan
CHUNG CHEONG BUG
Eunseong
Andong
CHUNG CHEONG NAM
Geum R.
Daejeon
GYEONG SANG BUG
Euiseong
Nag Dong R.
Pohang
Yeonmu
Gimcheon
Janghang
Gunsan
Iri
Gyeongju
Oggu
Jeonju
Daegu
JEON LA BUG
Ulsan
Milyang
Beobseongpo
GYEONG SANG NAM
Jinju
Masan
Jinhae
BUSAN
Gwangju
Hampyeong
Yeong San R.
Suncheon
Samcheonpo
JEON LA NAM
Chungmu
Jangseungpo
Mogpo
Yeosu
Mijo
Nagdong
Singeum
Wando
Jeju
JEJU
Seogipo
The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.
KOREA
KOREAN SEED PROJECT
PLANT LOCATIONS
POTATP SEED PLANTS
FIELD CROPS SEED PLANTS
POTATO CROPS EXPERIMENT STATION
FIELD CROP EXPERIMENT STATIONS
PRIMARY ROADS
RAILWAYS
IRRIGATION AND DEVELOPMENT AREA
SPECIAL CITIES
PROVINCIAL BOUNDARIES
INTERNATIONAL BOUNDARIES
0 20 40 60 80 100 120 140 160
KILOMETERS
0 20 40 60 80 100
MILES